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ORIGINAL RESEARCH

Linguistic demands of instructions: Effects on students' expectancy-value beliefs

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Abstract
Language in educational contexts is characterized by complex and cognitively demanding features that can be challenging to use. Based on situated expectancy-value theory (SEVT), we assumed that these linguistic demands can lower students' expectancies of performing well and the intrinsic value they place on tasks. This is particularly true of students with lower language abilities. Consequently, they may be less motivated to actively engage in academic tasks, potentially leading to lower academic achievement. To test this assumption, we linguistically varied an instructional statistics video into three conditions (easy, moderate, and difficult) and randomly assigned a total of 123 pre-service teachers to each condition. We measured their expectancies of success and intrinsic task value halfway through the instructional video and conducted an achievement test after the instruction. Drawing on path analysis, our results showed that different linguistic conditions had no significant effect on the students' expectancy-value beliefs. However, we found a significant positive effect of language ability and a significant negative effect of the interaction between the linguistically difficult instruction and language ability on expectancies of success. Contrary to our expectations, this indicates that high linguistic difficulty is associated with lower expectancies of success among students with increasing language abilities. Nevertheless, this finding emphasizes the importance of considering the fit between contextual and individual features. However, it did not have an indirect effect on student achievement. The findings are further discussed, highlighting their implications for future research and delineating linguistic design in educational contexts.

Keywords Linguistic demands · Language abilities · Expectancy-value theory · Expectancies of success · Intrinsic task value

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Introduction

Teaching and learning are inconceivable without language, as knowledge is transferred through it. In this context, language is characterized by linguistic features that are more complex and cognitively demanding than those of everyday language. For example, it involves technical vocabulary and complex grammatical structures that serve specific functions, such as precisely describing abstract concepts or constructing arguments (Morek & Heller, 2012; Schleppegrell, 2001; Zwiers, 2014). This renders the language used in educational contexts more challenging for students to comprehend and process (Snow & Uccelli, 2009). Mastery of these linguistic features is essential for students to successfully engage in academic discourse, follow oral instructions, and perform well in academic assessments (Gibbons, 2009).

We assume that these linguistic demands influence students' achievement motivation. To explain this assumption, we draw on situated expectancy-value theory (SEVT; Eccles et al., 1983; Eccles & Wigfield, 2020). SEVT emphasizes that task difficulty influences students' expectancies of success in performing well in tasks. Furthermore, it affects the subjective value they place on academic tasks. Therefore, we propose that students who encounter task difficulties due to linguistic demands in educational contexts may have lower expectancy and value beliefs, resulting in a lack of motivation to actively engage in these tasks (Bunch, 2013; Eccles & Wigfield, 2020; Eccles et al., 1983; Schleppegrell, 2001). Diminished motivation can diminish academic achievement (Eccles & Wigfield, 2020; Eccles et al., 1983). This is particularly true for students who have difficulty meeting linguistic demands in tasks because of their insufficient language abilities.

To the best of our knowledge, empirical studies examining the links between the linguistic demands of tasks, students' language abilities, and their motivational beliefs are sparse (Wirth et al., 2022). Thus, we empirically investigated the extent to which different levels of linguistic demand—based on the variation in difficulty-generating linguistic features—in an instructional video affect students' expectancies of success in comprehending and applying the content of the instruction, and the intrinsic task value of engaging with it. Furthermore, we examined the role of students' individual language abilities and the extent to which indirect effects on students' achievement can be identified. Therefore, our study contributes to the knowledge on linguistic demands in educational contexts and how language-related task difficulty affects motivational beliefs (Eccles, 2022; Lauermann, 2024; Wigfield & Eccles, 2024); it provides further insight into how the linguistic design of instructions may promote achievement motivation.

Linguistic demands in educational contexts

Language is essential "for getting things done" (Schleppegrell, 2012, p. 410). In the educational context, it is characterized by linguistic demands that are determined by certain lexical and grammatical features that differ from those of everyday language (Morek & Heller, 2012; Schleppegrell, 2001, 2012). These lexical and grammatical features include specific, infrequent, technical vocabulary and complex grammatical structures. Complex grammatical structures result, for example, from nominalization or the use of noun phrases to create a high lexical density that succinctly summarizes detailed information in few words. This increases the use of passive constructions that focus on the object and also leads to

longer sentences, with complex organization and the embedding of subordinate clauses and phrases, such as relative clauses or prepositional phrases (Schleppegrell, 2001; Zwiers, 2014). These demanding linguistic features serve specific functions, such as describing abstract concepts as clearly, effectively, and efficiently as possible, carrying out higher-order thinking processes, participating in discursive practices, constructing interpretations or argumentations, expressing ideas, and establishing abstractions or causal relationships (Schleppegrell, 2001, 2004; Zwiers, 2014).

However, these linguistic demands can increase the cognitive load for students when it comes to engaging with educational content, potentially hindering comprehension and learning for those without adequate language abilities to meet these demands (Bunch, 2013; Heller & Morek, 2015; Morek & Heller, 2012; Schleppegrell, 2004; Zwiers, 2014). Evidence from international school assessments shows that many students fail to develop sufficient reading skills, which are a key indicator of language ability. Such deficits have been linked to lower academic achievement compared to students with sufficient language abilities to cope with the linguistic demands and apply the communicative operations (Mang et al., 2023; Stubbe et al., 2024; Weis et al., 2019).

Addressing linguistic demands

One approach to addressing disparities in academic achievement related to differences in language abilities is to modify the linguistic demands. This involves systematically simplifying linguistic features to reduce the cognitive effort required for processing language in educational contexts, thereby facilitating access to subject-specific content (Cruz Neri & Retelsdorf, 2020; Maaß & Bredel, 2016). A large body of research has examined the effectiveness of linguistic simplification in improving students' academic achievement (see, for example, Kieffer et al., 2012; Li & Suen, 2012; and Pennock-Roman & Rivera, 2011 for reviews). A recent meta-analysis by Strohmaier et al. (2023) summarized 45 experimental studies on the modification of linguistic features in STEM subjects. Their analysis considered modifications at three levels: lexical and structural complexity (e.g. the use of simple words and shorter sentences), cohesion features (e.g. clearer connections between words and sentences), and linguistic clarity (e.g. content-related elaboration, such as summaries). Overall, these linguistic modifications had a significant positive impact on learning outcomes, particularly for students with limited prior knowledge.

To better capture linguistic modifications and allow for comparison across different experimental conditions of linguistic difficulty, Heine et al. (2018) proposed operationalizing linguistic features across three levels of difficulty. To do so, they identified three dimensions of linguistic demands—structural complexity, clarity of form-meaning relationships, and frequency—that need to be varied if different degrees of linguistic demands are to be examined. Based on this, they modeled three levels of linguistic demand, ranging from simple and explicit grammatical structures and high-frequency everyday vocabulary to the use of typical linguistic features of educational contexts that remain within the range of comparatively frequently occurring grammatical structures, and finally to complex and rarely anticipated grammatical structures and less frequent lexis. This type of operationalization has already been used in several empirical studies. The results showed that the students with poorer language abilities benefited most from simplified language. Meanwhile, those with

stronger language abilities could also successfully handle more linguistically complex tasks (e.g., Neumann et al., 2020; Plath & Leiss, 2018).

While the previous studies have focused on written texts, a recent study by Tippe et al. (2025) shows that the benefits of linguistic simplification also apply to oral language. The authors systematically varied the verbal complexity of teachers' oral explanations in terms of cohesion level and linguistic features at the word and sentence levels, creating a simple and difficult version. They found that students who listened to the simplified oral explanation achieved significantly higher test scores, suggesting that linguistic simplification can also facilitate students' comprehension of oral language.

Motivational consequences of linguistic demands from the perspective of Situated Expectancy-Value Theory

Dealing with linguistic demands in educational contexts may also affect students' achievement motivation. To explain this assumption, we draw on Situated Expectancy-Value Theory (SEVT; Eccles et al., 1983; Eccles & Wigfield, 2002, 2020) of achievement-related choices, persistence, and performance. Based on SEVT, students' motivation to engage in academic tasks and their achievement-related choices and performance depend on the following: (1) their confidence in their ability to perform well on the task (*expectancy of success*); and (2) the subjective *value* they place on a task, which includes beliefs about how interesting (intrinsic task value), useful (utility value), important (attainment), and costly (relative cost) a task will be. Accordingly, achievement motivation is highest when students expect to perform well in a task and consider the task valuable (Eccles & Wigfield, 2002, 2020; Eccles et al., 1983).

SEVT proposes that the expectancies of success and the intrinsic value individuals place on academic tasks or activities are not static but shaped in the moment as well as over time by various contextual features, experiences and social influences (Eccles & Wigfield, 2020; Eccles et al., 1983). Such contextual features include task difficulty, which is negatively related to students' expectancy-value beliefs (Eccles & Wigfield, 2020; Eccles et al., 1983; Wigfield & Eccles, 2024). In this context, the interaction between contextual and individual features is crucial. Accordingly, task difficulty levels must match students' individual needs and abilities to promote adaptive levels of perceived expectancies of success or intrinsic task value and increase achievement motivation (Eccles & Wigfield, 2020; Eccles et al., 1993; Linnenbrink-Garcia et al., 2016; Schiefele & Schaffner, 2020; Wenger et al., 2020). Within the SEVT framework, we argue that linguistic demands in educational contexts can be conceptualized as a form of task difficulty. These demands represent a situational factor that may influence achievement motivation differently for students with varying language abilities. That is, expectancies of success in academic tasks may be experienced by students who struggle dealing with linguistic demands receptively and productively. Particularly, this includes those who have difficulties understanding academic texts and speeches, or those who fail to express thoughts and ideas using appropriate linguistic features because of insufficient language abilities. They may also place less intrinsic value on these tasks, for example, because of the high effort costs associated with a high cognitive load or because they feel overchallenged (Bunch, 2013; Eccles & Wigfield, 2020; Schleppegrell, 2001). This could decrease their motivation to actively engage in these tasks, potentially lowering

academic achievement (Eccles & Wigfield, 2020; Eccles et al., 1983; Meyer et al., 2024; Nagengast et al., 2011; Trautwein et al., 2012).

Empirical evidence of links between linguistic demands and expectancy-value beliefs

Existing studies examining links between language aspects and motivational variables have shown that reading motivation influences reading comprehension and learning from texts (Cruz Neri et al., 2024; Goy et al., 2017; Retelsdorf et al., 2011; Wirth et al., 2022). These studies did not consider linguistic demands or motivation as a predictor; however, their findings suggest that achievement motivation or expectancy-value beliefs may in turn also be influenced by how well comprehension processes proceed due to difficulty based on linguistic features. Studies that consider linguistic demands and examine the links between linguistic features in text tasks, individual language abilities, and students' motivation, are sparse. Wirth et al. (2022) found only two empirical studies that examined how linguistic features of text tasks affect student motivation. One study varied the degree of personalization of texts (formal texts vs. personalized texts using possessive pronouns and direct address vs. named personalized texts using possessive pronouns and direct address by name; Reichelt, 2015). Another study compared different levels of linguistic demand in text tasks (Niazifar & Shakibaei, 2019). However, this study was conducted in the context of L2/second language acquisition. Thus, while different levels of linguistic demands in texts are compared and their effects on students' motivation are examined, the operationalization of the different levels of language demands is not based on the experimental variation of difficulty-generating linguistic features (e.g., Cruz Neri & Retelsdorf, 2022; Heine et al., 2018); rather, operationalization is based on the classification according to different levels of language acquisition (beginner level, language level 1, language level 2, etc.). Accordingly, Niazifar and Shakibaei (2019) provided one subgroup of students texts slightly above their current L2 language level and another subgroup of students texts slightly below their current L2 language level. They found that learning with texts with increased linguistic demands were associated with increased L2 reading motivation and promoted students' language learning. However, they did not examine the relationship between different levels of linguistic demand and students' language abilities. Instead, they used information about the students' current language learning levels to select participants who were all at the same level.

Furthermore, not only SEVT but also research on text comprehension highlights the importance of considering the interaction between individual and environmental features, or, in the context of this study, between linguistic demands and students' language abilities. Individual features, such as prior knowledge of content or language, are essential for comprehension processes and interact with the linguistic structure of texts (Kintsch, 1998; McNamara & Kintsch, 1996; Strohmaier et al., 2023). A systematic review by Cruz Neri and Retelsdorf (2022) on the influence of linguistic features on comprehension revealed that certain linguistic features do not affect students' achievement independently but do so in interaction with their reading skills. Therefore, the authors advocate that future studies should focus more closely on the interaction between individual and linguistic features.

Although empirical studies have examined links between reading motivation and comprehension (Cruz Neri et al., 2024; Goy et al., 2017; Retelsdorf et al., 2011) as well as between language abilities or linguistic demands and achievement (Neumann et al., 2020;

Mang et al., 2023; Plath & Leiss, 2018; Stubbe et al., 2024; Weis et al., 2019), few studies have explicitly investigated how linguistic demands interact with individual language abilities to shape achievement motivation and subsequent learning outcomes. Existing studies often define difficulty using broad language proficiency levels (e.g., Niazifar & Shakibaei, 2019) rather than specific linguistic features and rarely consider the moderating role of students' language abilities. Moreover, these studies primarily refer to written language rather than oral language. To address these research gaps, Wirth et al. (2025) systematically varied the linguistic demands in an oral instructional video based on Heine et al.'s (2018) language model and examined effects on students' boredom. Results showed that students who watched the linguistically difficult instructional video reported higher levels of achievement-related boredom and performed worse on a subsequent achievement test if they had lower language abilities. However, linguistically simplifying the instructional video did not clearly improve students' comprehension or reduce boredom. These results suggest that linguistic complexity in oral language can negatively affect emotional processes, especially for students with limited language abilities to cope with such linguistic demands. Due to the conceptual overlap between achievement emotions, such as boredom, and expectancy-value constructs, similar effects could also be expected for students' expectancy-value beliefs.

Overall, empirical evidence in this area remains scarce, and there is still a need for studies that (1) systematically compare different levels of linguistic demands, (2) consider the role of language abilities in students' expectancy-value beliefs, (3) examine how language abilities interact with language demands to affect expectancy-value beliefs, and (4) investigate how this consequently impacts students' achievement.

The present study

Based on the aforementioned research desideratum, we examined how three different conditions of linguistic demand (easy, moderate, and difficult) in an instructional statistics video affect students' *expectancies of success* and *intrinsic task value* (Research Question 1). Such explanations represent a central communicative practice in knowledge transfer and teaching (Morek, 2013). We hypothesized that linguistically difficult instructional videos would lead to lower *expectancies of success* and *intrinsic task value*. Conversely, linguistically easy instructional videos would lead to higher expectancy-value beliefs (*H1*). Subsequently, we investigated the role of students' *language abilities*. We first examined the extent to which students' *language abilities* affected their *expectancies of success* and *intrinsic task value* while learning with the instructional video (Research Question 2, *H2*). Additionally, we examined the extent to which the *interaction* between linguistic demands and students' language abilities affected their expectancy-value beliefs (Research Question 3). We assumed that the expected negative effect of the linguistically difficult instructional video on expectancy-value beliefs, as well as the expected positive effect of the linguistically easy instructional video on expectancy-value beliefs, would be stronger for students with lower language abilities than for students with stronger language abilities (*H3*).

High linguistic task demands in relation to individuals' language abilities and their expectancy-value beliefs have been found to affect students' academic achievement. Therefore, we examined the extent to which differences in students' *expectancies of success* and *intrinsic task value* based on language-related variables (*experimental condition*, *language abilities*, and *experimental condition* × *language abilities*) subsequently lead to differences

in their *achievement* (Research Question 4). We hypothesized a negative indirect effect of linguistically difficult instructional videos on students' achievement via *expectancies of success* and *intrinsic task value.* Additionally, we predicted a positive indirect effect of linguistically easy instructional videos on students' achievement via *expectancies of success* and *intrinsic task value*. Furthermore, we expect both these effects to be particularly strong for students with poorer language abilities (*H4*). Figure 1 graphically depicts these hypotheses.

Method

Sample and procedure

Data were collected from 123 pre-service teachers at a German university through convenience sampling. Initially, 161 pre-service teachers took part in the study; however, 38 participants had to be excluded due to dropout, as participation was voluntary and they could withdraw at any time. An implementation procedure was not feasible because no necessary data were available from these participants. The final sample thus consisted of 123 pre-service teachers. Of them, 60 (48.8%) were in a bachelor's program and 63 (51.2%) were in a master's program. Most (74.8%) were studying to become primary school teachers; the remaining 25.2% aimed to be lower- and middle-track secondary school teachers. Regarding age, 73.1% aged 21–25 years, 15% aged 26–30 years, 2% were younger than 21 years, and 10% were older than 30 years. Additionally, 87.0% of participants identified as female and 13.0% as male. Finally, 87.8% them grew up monolingually speaking German, while 12.2% reported having grown up multilingually.

Students watched a five-minute German language instructional statistics video on skewness and excess on their own mobile devices (smartphones, tablets, or laptops) during a lecture on research methods that is part of their teacher training program. This topic was chosen because it builds on the lecture's content, thereby reducing the influence of prior knowledge. The students were informed that although the study was voluntary, the topic was relevant to their final examinations, so that at least some extrinsic motivation should be present. Based on the language model by Heine et al. (2018), the instruction was varied linguistically. Accordingly, three versions were created: linguistically easy, moderate, linguistically difficult instructions. They differed in complexity based on linguistic features such as

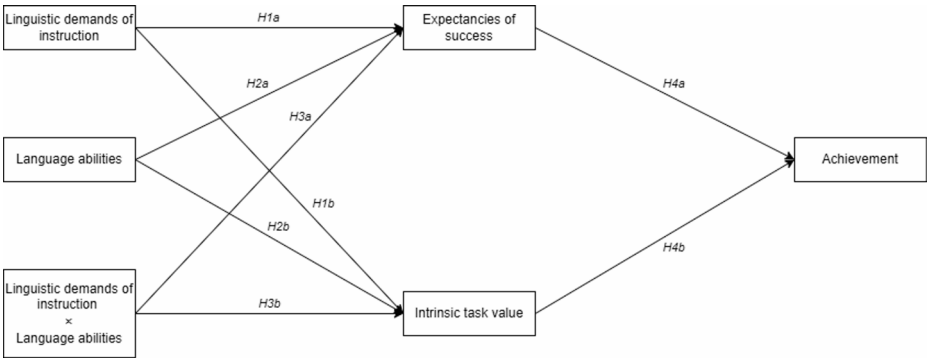

Fig. 1 Graphical depiction of our hypotheses

sentence structure, verb forms, pronouns, and vocabulary (Table 1). The linguistically easy instruction uses features oriented toward everyday language, such as direct speech, short active verb forms, simple main clauses, and frequently used vocabulary. Conversely, the linguistically difficult version contained a more complex sentence structure with a high density of information, nominalizations, and passive constructions. Additionally, this version of the explanation contained a higher proportion of less-frequent vocabulary words. The linguistically moderate instruction was located between the easy and difficult versions. The instruction content was the same across all three versions. To test the different experimental conditions of linguistic demands, we applied LATIC, a tool for linguistically analyzing text and item features (Cruz Neri & Klückmann, 2023), to the written transcripts of the instructional video. LATIC provides several readability indices, including the Flesch Reading Ease (Flesch,1948) and the readability index (LIX; Table 1; Anderson, 1981; Bamberger, 2006). Full German transcripts of each version and the corresponding English translations are available as supplemental material (Online Resource 1; see Appendix A). Participants were randomly assigned to one of the three instructional videos: 42 students watched the linguistically easy instructional video, 43 students watched the linguistically moderate version, and 38 students watched the linguistically difficult version. The video could not be skipped, ensuring that all students who completed the questionnaire watched it in its entirety. A screenshot of the instructional video can be found in Online Resource 4 (see Appendix A).

Students' expectancies of success and intrinsic task value were measured while they watched the instructional video, which was paused halfway between two thematic sections. Language abilities were assessed prior to viewing the video, and the achievement test was administered immediately afterwards. The entire procedure took approximately 25 min.

Table 1 Example of the linguistic variation of the instructional video in German and respective readability indices

Readability indices	Linguistically easy instructional video	Linguistically moderate instructional video	Linguistically difficult instructional video
	Die Schiefe ist linkssteil oder rechtssteil. [Skewness is right-skewed or left-skewed.] Den Exzess nennen wir auch Kurtosis oder Wölbung. [The excess we also call kurtosis.] Die Wölbung ist entweder breitgipflig oder schmalgipflig. [The kurtosis is either short-tailed or 0heavy-tailed.]	Die Schiefe kann linkssteil oder rechtssteil sein. [Skewness is right-skewed or left-skewed.] Den Exzess, den man auch Kurtosis oder Wölbung nennt, gibt es in breitgipfliger oder schmalgipfliger Form. [The excess, which is also called kurtosis, occurs in short-tailed or heavy-tailed form.]	Die Schiefe kann in linkssteiler oder rechtssteiler Variante auftreten und der Exzess, auch Kurtosis oder Wölbung genannt, in breitgipfliger oder schmalgipfliger Variante. [The skewness can occur in a right- or left-skewed variant, and the excess, also called kurtosis, in a short-tailed or heavy-tailed variant.]
Flesch Reading Ease	78.81 ("fairly easy")	73.83 ("fairly easy")	53.73 ("fairly difficult")
LIX	34.99 („easy")	42.03 ("moderately difficult")	58.24 ("difficult")

Note. English translations can serve to understand the text but do not necessarily represent the linguistic difficulties that were realized in German

Instruments

To assess the students' expectancy-value beliefs, language abilities, achievement, and sociodemographic data, an online questionnaire was used and implemented within the same online survey platform as the instructional video. Accordingly, students completed the questionnaire on their own mobile devices as well. *Expectancy-value beliefs* were assessed using two scales consisting of three items each (Rheinberg et al., 2019; Wigfield & Eccles, 2000). As indicators of *expectancies of success*, we used three items that measured students' beliefs about understanding the content and performing well in the subsequent achievement test. Items that measured students' interest in the topic served as indicators of their *intrinsic task values*. The items were rated on a four-point Likert-scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). We used the greatest lower bound (*glb*) as a reliability measure (Sijtsma, 2009; Ten Berge & Sočan, 2004). The *glb* for the expectancy scale was 0.89 and 0.88 for the intrinsic task value scale.

The self-developed *achievement test* was used to measure how much the students learned from the instructional video, specifically their conceptual understanding and ability to apply their knowledge, by testing their ability to reproduce and apply the terms and theorems taught in the video (e.g., "What is the shape of a distribution curve when the value of kurtosis is positive?"). The achievement test consisted of nine multiple-choice questions. For each correct answer, the participants received one point, with multiple-choice items scored only if all correct options within the item were selected. A maximum of nine points could be achieved. The multiple-choice format was chosen because it enables efficient, objective testing in a short amount of time (Simkin & Kuechler, 2005). The *glb* for the achievement test was 0.69. We observed neither floor nor ceiling effects, indicating that the achievement test was able to reliably capture the full range of student performance.

Students' *language abilities* were assessed using a single C-test for adult first- and second-language German learners. C-tests serve as a measure of general language ability, and the present language test was developed specifically to assess the language abilities of students in higher education (Eckes & Grotjahn, 2006; Mashkovskaya & Baur, 2016). In total, the participants had to fill in 25 blanks within five minutes. While evaluating the language test, we rated the correctness of the content of the filled-in blanks. One point was awarded for each blank that was filled correctly. A maximum score of 25 points was achieved, with higher scores indicating better language ability. The language test had *glb* of 0.97.

Data analysis

To answer our research questions, we constructed a path model with manifest variables in R Studio using the lavaan package (Rosseel, 2012). Path modeling was chosen because it allows the examination of complex relationships with all variables simultaneously in one model (Geiser, 2010). For our model, the experimental condition of linguistically varied instructional videos (linguistically easy instructional video, linguistically moderate instructional video, and linguistically difficult instructional video) was converted into two dichotomous predictor variables using dummy coding. The linguistically moderate instructional video was selected as the reference category. The resulting variables, *linguistically easy instructional video* and *linguistically difficult instructional video* indicated the extent to which the respective experimental conditions affected the dependent variables compared

to the reference condition. These two variables, together with individual *language abilities* and two interaction terms (*linguistically easy instructional video* × *language abilities; linguistically difficult instructional video* × *language abilities*), represented the exogenous variables in the model. *Expectancies of success*, *intrinsic task value* and *achievement test scores* represented the endogenous variables in the model, with expectancy-value beliefs acting as mediator variables. To ensure better interpretability of the effects, *language abilities*, *expectancies of success*, and *intrinsic task value* were mean-centered.

Results

Descriptive statistics

We found that the assignment of students to the three experimental conditions was balanced between Bachelor's and Master's students ($\chi^2(2) = 0.37$, $p = .831$). There were no significant differences in sociodemographic variables among the three experimental conditions (Online Resource 2; see Appendix A). We conducted a Kruskal-Wallis test to ensure that the language abilities were evenly distributed across the three experimental conditions and verified this requirement ($H(2) = 0.18$, $p = .915$).

Table 2 shows the mean values and standard deviations of students' individual *language abilities*, *expectancies of success*, *intrinsic task value*, and *achievement test scores* for the total sample. The mean values of all the variables were in the middle of their respective scales, indicating that the values tended to be evenly distributed. The low skewness of the distributions confirms that the mean value approximately corresponds to the median, indicating that there is no strong bias in any direction. Table 2 also presents the bivariate correlations between the experimental conditions of the linguistic demands of the instructional video, students' language abilities, expectancy-value beliefs, and achievements for the total sample. These initial results showed that neither linguistic demands nor language abilities alone were significantly correlated with the expectancy-value beliefs or achievement test scores. In contrast, as posited by SEVT, *expectancies of success* and *intrinsic task value* were significantly positively correlated with each other, and both variables were positively correlated with the achievement test scores. Descriptive statistics and correlations for each experimental condition are shown in Table 3. Kruskal-Wallis tests showed no significant differences in *language abilities* ($H(2) = 0.18$, $p = .915$), *expectancies of success* ($H(2) = 1.38$, $p = .502$), *intrinsic task value* ($H(2) = 3.51$, $p = .173$), and *achievement test scores* ($H(2) = 0.27$, $p = .873$) between the three experimental conditions.

Table 2 Descriptive statistics and correlations of the language test scores, expectancy-value appraisals, and achievement test scores for the total sample

1 Language abilities	M	SD	Skewness	Kurtosis	1	2	3
	11.74	6.57	0.02	2.54	-		
2 Expectancies of success	2.63	0.91	−0.09	2.00	0.09	-	
3 Intrinsic task value	2.07	0.73	0.26	2.77	0.12	0.20*	-
4 Achievement test score	5.32	1.82	0.06	2.32	0.10	0.25**	0.46***

Note. $N = 123$. *** The correlation is significant at $p < .001$. ** The correlation is significant at $p < .01$. * The correlation is significant at $p < .05$

Table 3 Descriptive statistics and correlations of the language test scores, expectancy-value appraisals, and achievement test scores for each experimental condition (instructional video)

Instructional video		*N*	M	SD	1	2	3
Easy	1 Language abilities	42	12.38	6.60	-		
	2 Expectancies of success	42	2.58	0.83	0.22	-	
	3 Intrinsic task value	42	1.97	0.75	−0.00	0.16	-
	4 Achievement test score	42	5.29	2.03	−0.05	0.22	0.56***
Moderate	1 Language abilities	43	11.28	6.94	-		
	2 Expectancies of success	43	2.75	0.88	0.30	-	
	3 Intrinsic task value	43	2.24	0.79	0.26	0.30*	-
	4 Achievement test score	43	5.26	1.90	0.32*	0.10	0.45**
Difficult	1 Language abilities	38	11.55	6.23	-		
	2 Expectancies of success	38	2.53	1.03	−0.24	-	
	3 Intrinsic task value	38	2.00	0.61	0.12	0.09	-
	4 Achievement test score	38	5.42	1.48	−0.00	0.50**	0.36*

Note. $N = 123$. *** The correlation is significant at $p < .001$. ** The correlation is significant at $p < .01$. * The correlation is significant at $p < .05$

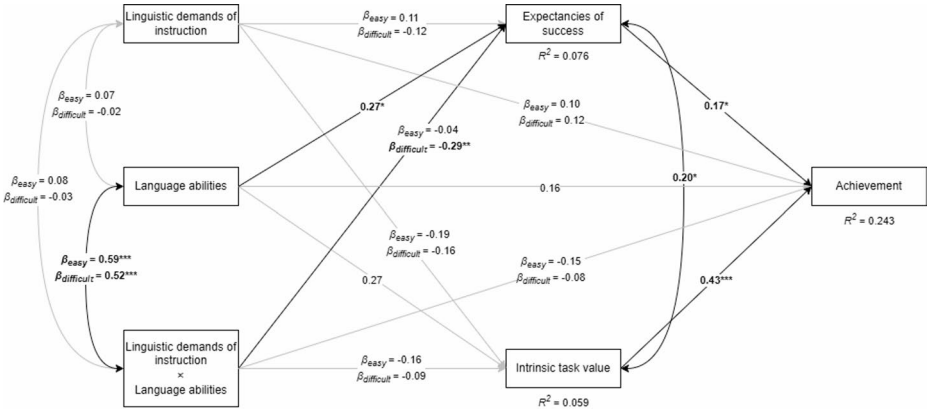

Fig. 2 Path model showing the standardized regression coefficients and covariances. Note: Highlighted are the significant paths. β_{easy} Linguistically easy instruction. $\beta_{difficult}$ Linguistically difficult instruction. *** $p < .001$. ** $p < .01$. * $p < .05$

RQ 1: To what extent do the different experimental conditions of linguistic demands (linguistically easy, moderate or difficult instructional video) lead to differences in students' expectancies of success and intrinsic task value?

To answer this question, we conducted a path model with *linguistically easy instructional video*, *linguistically difficult instructional video*, individual *language abilities* and their respective interactions (*linguistically easy instructional video* × *language abilities; linguistically difficult instructional video* × *language abilities*) as exogenous variables, *expectancies of success* and *intrinsic task value* as endogenous and mediator variables, and *achievement test scores* as endogenous variables (Fig. 2). Since the variables were not normally distributed, we used the maximum likelihood method with robust standard errors (MLR) as our estimation method, as this is robust to violations of such prerequisites. The model fit could

be considered good with $\chi^2(1)=3.03$, $p=.082$, $\chi^2/df=3.03$ (Kline, 2016). The standardized root mean square of residuals (SRMR = 0.03) and comparative fit index (CFI = 0.95) also indicated a good fit, whereas the root mean square of the approximation errors (RMSEA = 0.13) suggested a less adequate model fit (Bentler, 1990; Browne & Cudeck, 1993; Hu & Bentler, 1999; Kline, 2016; Steiger, 1990).

To answer Research Question 1, the direct effects of *linguistically easy instructional video* and *linguistically difficult instructional video* on students' *expectancies of success* and *intrinsic task value* were of interest. The results showed that the effects on students' *expectancies of success* and *intrinsic task value* were not significant. This indicates that, compared to the linguistically moderate instructional video, both the linguistically easy and difficult instructional videos were not associated with either significantly higher or lower expectancies of understanding the topic and performing well on the upcoming achievement test, or a significant increase or decrease in the intrinsic value that students place on the given task.

RQ 2: To what extent do students' individual language abilities affect their expectancies of success and intrinsic task value?

As the effect of different experimental conditions of linguistic demands on students' expectancy-value beliefs was found to be non-significant, the question arises as to what extent students' language abilities play a role in this context. First, we examined the effects of students' individual *language abilities* on their *expectancies of success* and *intrinsic task value*. The results of our path model showed a significant positive effect of *language abilities* on *expectancies of success* ($\beta=0.27$, $SE=0.02$, $z=2.13$, $p=.033$), indicating that students with stronger language abilities reported higher expectancies to understand the topic and to perform well in the upcoming achievement test. For *intrinsic task value*, there was no significant effect of *language abilities* ($\beta=0.27$, $SE=0.02$, $z=1.62$, $p=.104$). This implies that students did not place significantly different values on the current task despite their different language abilities.

RQ 3: To what extent does the interaction of the different experimental conditions of linguistic demands and students' individual language abilities affect their expectancies of success and intrinsic task value?

After looking at the effects of the *linguistically easy instructional video*, the *linguistically difficult instructional video* and individual *language abilities* on *expectancies of success* and *intrinsic task value* respectively, we were interested in examining how the experimental condition and individual language abilities interact with each other. For this purpose, we created two interaction terms (*linguistically easy instructional video* × *language abilities; linguistically difficult instructional video* × *language abilities*) and examined their effects on students' expectancy-value beliefs. The results of the path model showed that the interaction of the *linguistically easy instructional video* and *language abilities* had non-significant negative effects on *expectancies of success* ($\beta=-0.04$, $SE=0.02$, $z=-0.38$, $p=.706$) and *intrinsic task value* ($\beta=-0.16$, $SE=0.03$, $z=-1.19$, $p=.232$). Similarly, the effect of the interaction between the *linguistically difficult instructional video* and *language abilities* on *intrinsic task value* was negative but not significant ($\beta=-0.08$, $SE=0.02$, $z=-0.78$, p

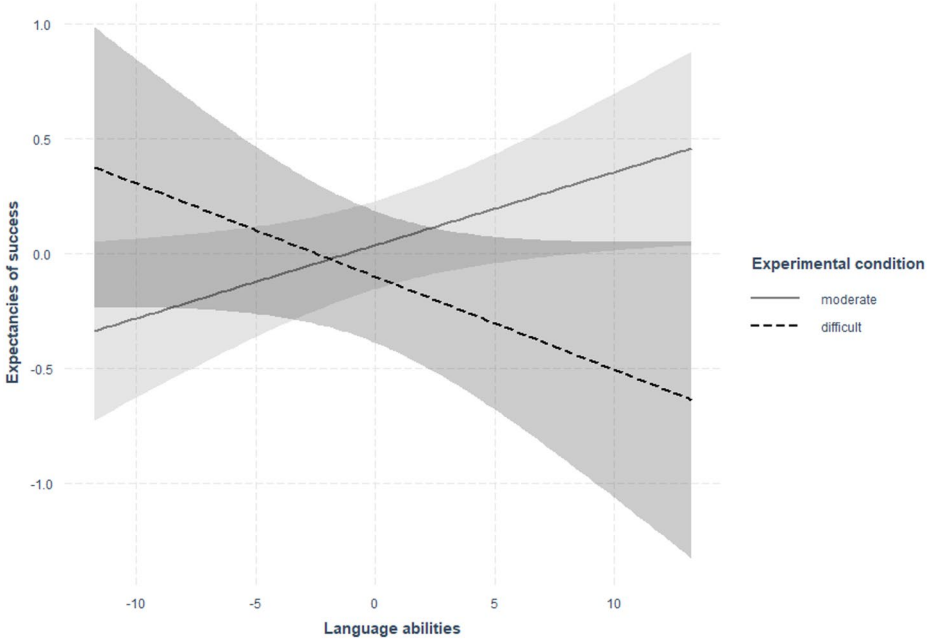

Fig. 3 Plot of the effect of the interaction between the linguistically difficult instructional video and language abilities on expectancies of success

=.435). However, we found a significant negative effect of the interaction between the *linguistically difficult instructional video* and *language abilities* on students' *expectancies of success* ($\beta = -0.29$, $SE = 0.03$, $z = -2.66$, $p = .008$). This indicates that the *linguistically difficult instructional video* was associated with lower *expectancies of success* among students as their language abilities increased (Fig. 3).

RQ 4: To what extent do differences in students' expectancies of success and intrinsic task value based on the language-related variables subsequently lead to differences in their achievement?

After examining the effects of *linguistically easy instructional video*, *linguistically difficult instructional video*, individual *language abilities* and the interaction between experimental conditions and language abilities (*linguistically easy instructional video* × *language abilities; linguistically difficult instructional video* × *language abilities*) on students' expectancy-value beliefs, we were interested in determining whether there was an indirect effect on students' achievement. Here, the results first showed a significant direct positive effect of *expectancies of success* on *achievement test scores* ($\beta = 0.17$, $SE = 0.16$, $z = 2.01$, $p = .027$), indicating that students with higher expectations to perform well in the upcoming achievement test do achieve better results on this test. The results also showed a significant direct positive effect of intrinsic task value on achievement test scores ($\beta = 0.43$, $SE = 0.18$, $z = 6.06$, $p < .001$). The direct effects of *linguistically easy instructional video*, *linguistically difficult instructional video*, *language abilities*, *linguistically easy instructional video* × *language abilities*, and *linguistically difficult instructional video* × *language abilities* on *achieve-*

ment test scores were non-significant. Consequently, there were neither significant partial indirect effects of these variables on *achievement test scores* via *expectancies of success* and *intrinsic task value* nor significant total indirect effects, except for a total indirect effect of language abilities on achievement test scores via expectancies of success and intrinsic task value ($\beta = 0.16$, $SE = 0.02$, $z = 1.97$, $p = .049$). A table showing the results of all the direct and indirect effects on achievement test scores can be found in Online Resource 3 (see Appendix A).

Discussion

In the present study, we examined whether different experimental conditions of linguistic demands in an instructional video (linguistically easy, moderate, and difficult) affect students' expectancies of success and intrinsic task value (RQ 1). Additionally, we investigated the role of individual language abilities: first, the effect of language abilities on expectancy-value beliefs (RQ 2), and second, the effects of the interaction of language abilities and linguistic demands on students' expectancy-value beliefs (RQ 3). We derived these research questions from the discourse on the difficulty-generating linguistic features of academic languages, such as complex grammatical structures and infrequent vocabulary (Schleppegrell, 2001; Zwiers, 2014), as well as from the perception of task difficulty as an important contextual feature in learning and achievement situations that are negatively related to expectancy-value beliefs in the framework of SEVT (Eccles et al., 1983; Wigfield & Eccles, 2024). We assumed that linguistically difficult instructional videos would lead to lower expectancies of success and lower intrinsic task value, whereas linguistically easy instructional videos would relate positively to expectancy-value beliefs and that this effect would be particularly strong for students with lower language abilities. As both linguistic demands and expectancy-value beliefs affect individuals' academic achievement (Mang et al., 2023; Meyer et al., 2024; Nagengast et al., 2011; Stubbe et al., 2024; Trautwein et al., 2012; Weis et al., 2019), we further examined whether language-related variables had indirect effects on students' achievement test scores via expectancy-value appraisals (RQ 4).

Regarding RQ 1, the results of our study showed that neither the linguistically easy nor linguistically difficult instructional videos had significant positive or negative effects on students' expectancies of success and intrinsic task value compared to the linguistically moderate instructional video. This finding suggests that high linguistic demands do not appear to be generally negatively associated with expectancy-value beliefs and that a mere reduction in linguistic demand may not be sufficient to increase these beliefs. Instead, other factors such as individual differences in language abilities play a more decisive role in shaping motivational outcomes. This is consistent with the fact that the fit between contextual and individual features is emphasized in SEVT (Eccles & Wigfield, 2020) and corresponding research as well as in research language comprehension (Cruz Neri & Retelsdorf, 2022; Eccles et al., 1993; Kintsch, 1998; Schiefele & Schaffner, 2020; Wenger et al., 2020). Therefore, individual language abilities were considered in the context of the second and third research questions.

Concerning individual language abilities, we found a significant positive effect of language abilities on expectancies of success (RQ 2), and a significant negative effect of the interaction between the linguistically difficult instructional video and students' language

abilities on expectancies of success (RQ 3). These results suggest that an increase in language abilities is associated with higher expectancies of understanding a topic and performing well on achievement tests. However, this correlation was reversed when the interaction between linguistic demands and students' language abilities was considered. That is, an increase in language abilities was associated with *lower* expectancies of success under the linguistically difficult experimental condition. This finding contradicts the hypothesis that students with poorer language abilities will report lower expectancies of success under linguistically difficult conditions, which was based on prior research suggesting that students with poorer language abilities benefit most from simplified linguistic features, while students with stronger abilities can cope well with high linguistic demands (Neumann et al., 2020; Plath & Leiss, 2018). However, our findings align with the SEVT notion (Eccles & Wigfield, 2020) and research on language comprehension (Cruz Neri & Retelsdorf, 2022; Kintsch, 1998; McNamara & Kintsch, 1996; Strohmaier et al., 2023), which suggests that achievement-related outcomes are shaped not solely by contextual features, but by the interaction of contextual and individual features. However, we found no evidence that expectancies of success were fostered when there was a good fit between the linguistic demands of the instructional video and students' individual language abilities. Possible explanations for these unexpected or nonsignificant findings are discussed in the limitations section.

Interestingly, intrinsic task value was not significantly related to language abilities or affected by the interaction between language abilities and linguistic demands at all. In the context of SEVT (Eccles & Wigfield, 2020), this could indicate that other facets of task value may have influenced the results. For example, although the topic may be related to low intrinsic value, its perceived importance could have been increased because it was announced as relevant to the end-of-semester examination. This may have reduced the variability in intrinsic task value and limited the differentiation between students' motivational responses. Accordingly, the different facets of task value should be more clearly distinguished and controlled to avoid potential biases.

It also seems important to more closely examine the effects of the interaction between linguistic demands and individual language abilities on motivational outcomes in future studies to derive more reliable and generalizable findings and precise implications for language design in educational contexts that foster high expectancy and value beliefs. Here, it could be informative to use person-centered approaches to investigate how expectancy-value beliefs develop and change in or across learning or achievement situations within persons and whether intra-individual differences can be attributed to situational characteristics such as linguistic demands of academic tasks and their interaction with individual language abilities (Eccles, 2022; Pekrun & Marsh, 2022).

Regarding Research Question 4, we found significant positive effects of expectancies of success and intrinsic task value on students' achievement test scores. This indicates that higher expectations of performing well in a task or activity, as well as higher values placed on these tasks or activities, lead to higher academic achievement. This finding is in line with theoretical assumptions within the SEVT framework (Eccles & Wigfield, 2020) and corresponding empirical findings (Meyer et al., 2024; Nagengast et al., 2011; Trautwein et al., 2012). However, to answer Research Question 4, expectancy-value beliefs were not of interest as predictors but as mediators. We found that students' achievement test scores were not significantly and directly affected by the different experimental conditions of linguistic demands, students' language abilities, or the interaction between these variables,

nor were they indirectly affected by these language-related variables through expectancy-value beliefs. Thus, while previous empirical studies in the research discourse on linguistic demands in educational contexts have found significant links between linguistic demands, language abilities, and academic achievement (Mang et al., 2023; Stubbe et al., 2024; Weis et al., 2019), these effects were not observed in the present study. This finding raises the question of whether aspects such as sample size could have led to these effects not being strong or consistent enough in this study and indicates a need for further research to capture the possible mediation effects of motivational variables.

In summary, the findings of this study indicate that linguistic demands in educational contexts by themselves do not seem to affect students' expectancy-value beliefs, but that the consideration of these linguistic demands in relation to individual language abilities seems to be important. Although we could not fully support all our hypotheses, we were able to make an important contribution to previous research. The literature has thus far primarily focused on different aspects when examining links between linguistic features and motivational aspects; For example, achievement motivation's role as a predictor of reading comprehension and learning from texts (Cruz Neri et al., 2024; Goy et al., 2017; Retelsdorf et al., 2011) and students' motivation in L2/second language acquisition (Niazifar & Shakibaei, 2019). However, we considered high linguistic demands as a determining factor for students' motivational beliefs. Additionally, we considered linguistic demands as a measure of task difficulty within SEVT (Eccles & Wigfield, 2020; Eccles et al., 1983), which represents an important contextual factor in this research area that has not yet been studied (Lauermann, 2024; Wigfield & Eccles, 2024).

Limitations and suggestions for future research

This study had some limitations. The first concerns the operationalization of linguistic demands. We varied the linguistic features in our instructional video based on Heine et al. (2018), who reviewed the state of research on difficulty in generating linguistic features, derived three principles of linguistic structure that differ in linguistic difficulty, and then tested the different degrees of linguistic complexity of our oral explanation objectively using LATIC (Cruz Neri & Klückmann, 2023). However, we did not empirically measure how difficult it was for the participants to perceive different levels of linguistic complexity. This is important to note as empirical evidence on the extent to which linguistic features impair comprehension and achievement is mixed (Cruz Neri & Retelsdorf, 2022 for a systematic review on linguistic features and their empirical evidence).

Another limitation was the lack of a prior knowledge test. The use of a prior knowledge test could be relevant when interpreting the results of our achievement test, because prior knowledge influences learning outcomes (Shapiro, 2004). However, it could also be argued that an assessment of prior knowledge was unnecessary because we randomly assigned participants to different experimental conditions in our study. The disadvantage of a prior knowledge test could be that it could influence students' expectancy-value beliefs depending on factors such as test conditions or the fact that the prior knowledge test is not graded (Finn, 2015). It would then be difficult to determine whether the motivational beliefs measured in this study were related to the variables examined or were influenced by the prior knowledge test.

Some characteristics of our sample should also be considered when interpreting the findings. The participants were university students, who are generally already more linguistically proficient than school students and may therefore cope relatively well with higher linguistic demands (Cummins, 2000). Consequently, their language abilities were likely more homogeneous, which may have limited the potential to detect significant differential effects of linguistic demands. Additionally, the sample included a high proportion of female students. Prior research suggests that gender differences may play a role in statistics learning, with females often reporting lower confidence and more negative attitudes towards statistics compared to males (Chiesi & Primi, 2015; Rejón-Guardia et al., 2019; Schram, 1996). This may have influenced motivational outcomes in our study. Finally, the relatively small sample size may have contributed to the non-significant correlations, such as those between the language variables and achievement, which contrasts with findings from prior research (e.g., Mang et al., 2023; Stubbe et al., 2024; Weis et al., 2019). Taken together, the relatively homogeneous, small, and gender-imbalanced sample likely limits the generalizability of the results and may partly explain why some hypothesized effects did not emerge.

If future research addresses these limitations, one potential next step could be to recruit larger, more heterogeneous samples to strengthen generalizability. Including school students could be valuable here, as greater heterogeneity in language abilities is expected at earlier stages of education, when familiarity with academic language practices is still developing. Comparative studies between school and university students could provide insight into which linguistic features are particularly relevant to certain groups. It could also be useful to only manipulate individual linguistic features rather than several simultaneously to obtain more robust evidence that the examined linguistic features are indeed demanding for students and to detangle their specific effects. Finally, examining the effects of linguistic demands across different subject domains would help clarify whether the observed patterns are domain-specific or generalizable.

In summary, our findings suggest links between linguistic demands, language abilities and students' expectancy-value beliefs. However, the limitations of this study highlight the need for further research to generate valid, generalizable results and implications for linguistic design in educational contexts.

Conclusion

In the present study, we aimed to contribute to the knowledge about the relationship between linguistic demands in educational contexts and students' expectancy-value beliefs. This was done using an experimental study design, in which we linguistically varied an instructional video into three experimental conditions, to which students were randomly assigned. We found that the assumed negative effect of the linguistically difficult instructional video on students' expectancy-value beliefs tended to be evident but was not significant, that individual language abilities had a positive effect on expectancies of success, and that the interaction of the linguistically difficult instructional video and students' individual language abilities had a significant negative effect on their expectancies of success. Accordingly, the present study suggests that expectancies of success are lower when the linguistic demands are below individual's language abilities. However, the results of our study do provide some initial indications that task difficulty due to high linguistic demands, in relation to individual

language abilities to cope with these demands, may influence motivational or expectancy-value beliefs. To generate more substantiated results, this study suggests that future research should consider a larger sample and use person-centered study designs. The corresponding findings could be of great relevance for language design in educational contexts, which is aligned with students' individual language abilities in such a way that high expectations of success and task values are anticipated, fostering students' motivation to engage and persist in academic tasks and eventually their academic achievement.

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Data availability Supplementary research data for this work are available as online resources.

Declarations

Competing of Interest The authors report there are no competing interests to declare.

Ethics approval and consent to participate: The authors state that all relevant ethical guidelines and principles were carefully considered in the preparation of this scientific article. The conduct of the research, as well as data collection, analysis, and interpretation, was performed in strict adherence to ethical standards to ensure that potential impacts on humans and the environment were minimized. Owing to the fact that in Germany no formal approval by an ethics committee is required prior to conducting a scientific study, no such statement exists. The authors further state that prior to the quantitative survey, all participants were comprehensively informed about the objectives and purpose of the study and about the persons responsible for conducting the survey. They were also provided with detailed information regarding the secure and compliant handling of their data in accordance with data protection regulations. Participation was entirely voluntary, and participants had the right to withdraw at any time without any consequences. Participant privacy and confidentiality were always respected, and appropriate measures were taken to maintain anonymity.

Consent for publication: The publication of this manuscript has been approved by all authors. All authors have reviewed the manuscript and agree with the listed order of authors. All authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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