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Associations between Autonomy-Supportive Teaching, the Use of Non-Academic ICTs, and Student Motivation in English Language Learning

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Abstract: During puberty, children experience an increased need for autonomy in all areas of their lives, including school. However, teachers use different levels of autonomy-supportive teaching strategies, which might have detrimental effects on students' perceived competence and—building on self-determination theory—motivation to learn. In this preregistered study, we investigated whether students could buffer the negative impact of little perceived autonomy support in the English-language classroom on their perceived competence and, consequently, two motivational outcomes (grade aspirations, intrinsic motivation) by using non-academic English-language ICTs in their free time. We calculated several (moderated) mediation models with a Bayesian estimator, using data from N = 1288 Austrian secondary school students who answered three online questionnaires between May 2022 and April 2023. The results showed that perceived competence predicts both types of motivation and is influenced by students' use of non-academic English-language ICTs. However, the effects of autonomy-supportive teaching strategies depend on which variables are included in the models. Our study therefore highlights the importance of examining several aspects of autonomy-supportive teaching and including variables from outside the school to represent the complex environment in which students' motivation is shaped.

Keywords: self-determination theory; basic needs; English language learning; non-academic ICTs; autonomy-supportive teaching

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1. Introduction

Motivational processes play a crucial role in every area of education and are a pivotal requirement for life-long learning [1], a skill that is highly needed in our ever-changing world. Especially when it comes to adapting to new and sustainable lifestyles or technologies, a high motivation to learn can be beneficial for these processes of change [2]. Traditionally, motivation is distinguished into intrinsic motivation, where learning is undertaken for the learner's inherent interest and enjoyment, and extrinsic motivation, where the learner strives to attain a certain outcome separate from learning itself [3]. Numerous studies and meta-analyses have shown that higher intrinsic motivation promotes, among others, energy for action [4], engagement, persistence, well-being, and even better grades [5]. However, educational systems around the world also contain aspects that might be more extrinsically motivating, such as receiving good grades in high-stakes tests. While it presumably lies in human nature to be innately curious and interested in learning, self-determination theory (SDT [6]) proposes that, to maintain (intrinsic) motivation, the basic needs for autonomy and competence must be satisfied [7]. In adolescence, the need for autonomy in particular has been found to increase [8], posing important implications for learning environments and educators. This increasing need for autonomy and independence as students enter adolescence makes it particularly important to understand the

effects of teachers' autonomy-supporting teaching strategies in the context of secondary school classrooms (although autonomy-supportive teaching is relevant across contexts).

While countless studies [9] have examined the relevance of basic need satisfaction for school-related motivation, most of them focus on STEM subjects, leaving a gap for language learning, especially in secondary school. Furthermore, in studies examining language learning in school, one factor of increasing importance in the past decades has consistently been overlooked: the influence of informal learning outside of the school. In our digitalized age, students are now able to access a plethora of content in almost every language, with content in English dominating the internet [10]. However, little to nothing is known about the effects of this type of self-determined and informal learning on students' motivation, achievement, or general experiences in school. It might well be the case that students who experience a lack of autonomy inside the classroom try to (consciously or unconsciously) compensate for this lack by engaging with non-academic English-language content in their free time, which might in turn affect their perceived competence and hence protect their intrinsic motivation to learn the language from detrimental effects of an unsatisfied need for autonomy.

In this study, we draw upon these theoretical assumptions and use self-determination theory to longitudinally investigate the relationships between adolescents' English-related basic needs and school-related motivation (in terms of intrinsic motivation and extrinsic achievement aspirations), while considering the use of non-academic English-language information and communication technology (ICT) as a moderating factor. In doing so, we aim to contribute to the lack of studies about self-determination theory in language learning and open up a novel field of research incorporating ICTs into motivation research by offering initial evidence of their theoretical and practical relevance.

1.1. Basic Needs and Intrinsic Motivation

Self-determination theory is a comprehensive macro-theoretical framework of human motivation that is built around six overlapping mini-theories [4]. This study focuses on cognitive evaluation theory and basic need satisfaction theory.

Cognitive evaluation theory explains how social contexts shape intrinsic motivation—the highest level of self-determination. Intrinsic motivation energizes people to do things for their own sake. Students experiencing such inherent motivation derive personal rewards from learning tasks and need no further reward or compensation [4], and this energization is further connected to feelings of interest and enjoyment. Students' amount of intrinsic motivation varies between academic subjects (e.g., [11,12]); they show higher intrinsic motivation in subjects they feel align better with their personal interests. Intrinsic motivation can be shaped by the characteristics of the social environment and the accompanying satisfaction of basic needs.

Basic need satisfaction theory proposes the universal importance of three basic needs—autonomy, competence, and social relatedness—for optimal motivation and well-being. Students experiencing autonomy perceive that they can decide for themselves which exercises and tasks to complete. Perceived competence relates to students feeling capable and self-efficacious in dealing with the demands of their classroom environment. Academic self-concept is closely related to the need for competence satisfaction postulated in SDT [10]. Social relatedness refers to students' feeling of belonging and being connected with important others (e.g., classmates, friends, teachers, parents).

In the educational context, recent meta-analytic evidence shows perceived competence to be the strongest predictor for intrinsic motivation out of the three basic needs [5,13,14]. This is in accordance with other prominent theoretical frameworks—such as expectancy-value theory [15,16] or person–object theory of interest [16]—that posit a strong link between competence beliefs and intrinsic aspects of motivation. Social contexts can shape need satisfaction and subsequently affect individuals' intrinsic motivation and well-being.

1.2. Autonomy-Supportive Teaching

An autonomy-supportive context is expected to promote the satisfaction of all three basic needs [4]. Meta-analytic evidence supports this basic tenet of SDT and also suggests that autonomy-supportive teaching strategies lead to higher intrinsic motivation via basic needs [13,17]. What can be considered an autonomy-supportive context is less clear, however, as several conceptualizations and scales have been used in SDT research.

On a conceptual level, autonomy-supportive teaching typically entails (1) the adoption of student-focused attitudes, including offering choices and inviting students to pursue their personal interests (=student focus; [18–20]), and (2) working constructively with students to help them successfully accomplish important learning tasks (=understanding; [21]). These teaching strategies concur with a newly developed classification system developed by a panel of 34 international SDT researchers, who identified 11 autonomy-supportive teacher behaviors, including "allow for student input or choice", "teach in student preferred ways", and "rely on invitational language" [22].

Although it is widely accepted that autonomy support can be provided through several instructional strategies, existing systematic research syntheses (meta-analyses, e.g., [13]) have not distinguished between different teaching strategies. Also, many studies only considered an overall autonomy-supportive atmosphere (e.g., [23]) or a single autonomy-supportive strategy (e.g., [24]). For notable exceptions, see the studies by Flunger et al. (2022; [25]), which investigated students' perceptions of the teaching strategies of providing choices, providing meaningful rationales, accepting frustration, and stimulating interest, and Patall et al. (2018; [26]), which showed that several autonomy-supportive strategies (provision of choices, consideration of students' opinions/interests, opportunities to work in your own way) are distinguishable in the science classroom. Especially when teachers provide their students with choices, it leads students to experience control and perceive competence.

Teachers' autonomy support has been shown to be more important for students' need satisfaction than parents' autonomy support [13]. The effect of parental support also decreases as students grow older. Hence, there is a need for more studies on the relative impact of different teaching strategies on student outcomes. In this study, we therefore focus on two perceived autonomy-supportive teaching aspects—providing choices to students and teachers' constructive support—and their impact on students' perceived competence and intrinsic motivation. We examine this path via perceived competence as this basic need was found to be both an important consequence of autonomy-supportive teaching and a crucial antecedent of intrinsic motivation.

1.3. Grade Aspirations

Aspirations are personal goals that individuals hope to attain in the future [27]. At the end of secondary school, aspirations typically include achievement strivings and educational or employment plans. Put differently, they represent the reasons or motives for studying [3]. These aspirations are more extrinsically motivated, as they represent striving for the attainment of a valued outcome [4]. Grounded in theory (SDT [6]; expectancy-value theory [15]) and demonstrated in empirical findings ([28,29]), these wishes are related to competence expectations in predicting academic achievement, future educational behavior, and career plans.

In the Austrian educational system, the upper secondary school graduation exam ("Matura") is a low- to middle-stakes test that provides students with valuable information for their further career and educational choices. Achievement strivings related to this exam can be seen as consequences of competence expectations and are a prerequisite for academic achievement and later educational and career aspirations. Specific aspirations related to achievement tasks—in contrast to more general intentions—particularly predict later student achievement outcomes [30]. Previous results on academic striving for better marks largely come from STEM domains [26,29]; empirical evidence from language subjects is largely missing. In our study, we use grade aspiration for the written graduation exam in

English as a more extrinsic outcome, which is conceptualized as a consequence of students' competence expectations in English.

1.4. Non-Academic ICTs and Learning Outcomes

Especially during the COVID-19 pandemic, the use of information and communication technology (ICT) in education rapidly grew worldwide as classrooms needed to be transferred to the online context. But also outside of school, students are increasingly used to interacting with and through ICTs [31]. In 2022, 96% of Europeans between 16 and 29 years old reported using the internet on a daily basis, with social media leading the chart of usage possibilities [32].

When examining the impact of ICTs on education, studies need to distinguish different contexts for and types of ICT use. Students can either use ICTs at school or at home and either for learning (academic ICTs) or for entertainment (non-academic ICTs). Even though many educators and parents fear a general negative impact of ICT use on learning outcomes "because students may spend their time using ICT for leisure activities instead of using the tool for learning" ([33], p. 1), empirical results are mixed. While some studies find that spending more time on non-academic ICTs (like playing games, social networking, and downloading or consuming music and movies) was negatively associated with academic achievement (e.g., [33–35]), other studies have shown positive effects in several domains like mathematics, science, and languages (e.g., [36,37]).

Concerning (English) language learning, ICTs can offer many benefits, like wide access to additional information and material, authentic input from and facilitated contact with native speakers, and the possibility to choose content of interest. On social media, content is often created and consumed in the English language, even by users who are not native English speakers, increasing the amount of time spent engaging with the language. This self-determined contact with a foreign language makes it likely that using non-academic ICTs for language learning promotes learner autonomy and motivation, the foundation of meaningful and life-long learning ([33,38]). Studies on this, however, are lacking. In our study, we therefore examine whether the use of non-academic English language ICTs outside of school helps students with little perceived autonomy in the classroom (in terms of teachers' tendency to provide choices) to regain some of this autonomy.

1.5. The Present Study

The aim of the present study was to contribute to a better understanding of the processes that influence students' motivation to learn and that, consequently, lead to sustainable education. Building on the framework of self-determination theory [6], this study investigates the effect of two autonomy-supportive teaching strategies, i.e., providing choices and constructive teacher support in the English-language classroom, on students' perceived competence and continuative, school-related motivation. By including students' use of non-academic English-language ICTs in their free time as a potential moderating factor, we aim to tackle the existing gap regarding the influence of informal learning on school outcomes—a factor that often is neglected by educational researchers. As self-determination theory assumes that students subjectively experience autonomy-supportive teaching differently, which in turn affects their motivation to different degrees, we focused on students' individual perceptions of autonomy-supportive teaching rather than considering this teaching attitude to be a general principle in the classroom.

We examined our research questions in the domain of English as a foreign language, a subject taught in secondary Austrian schools normally starting in grade 5. Several studies have found that students typically report relatively higher intrinsic motivation for foreign language subjects than for mathematics or first language (e.g., [11,39]). However, studies on English-language learning in secondary schools in Austria are currently lacking and only a few studies so far have examined scholastic language learning within the framework of the cognitive evaluation and basic need satisfaction theories (for a systematic review, see [40]).

Basing our assumptions on the extensive body of empirical findings regarding autonomy-supportive teaching and basic need satisfaction ([5,9,13,21,22]), we expect both facets of autonomy-supportive teaching to positively predict perceived competence in the subject English as a foreign language (Hypotheses 1a and 1b), and perceived competence to positively predict intrinsic motivation and grade aspiration (H2a and 2b). Regarding indirect effects, we expect the effects of both facets of autonomy-supportive teaching to be mediated by perceived competence, with a more autonomous teaching style leading to higher competence and consequently positively predicting intrinsic motivation and grade aspiration (H3a–3d). Accordingly, we expect that little perceived autonomy in the classroom (in terms of the teacher providing choices) leads to reduced perceived competence. By including students' use of non-academic English-language ICTs in this study, we aim to examine whether students can compensate for this non-satisfied need for autonomy and its detrimental effect on competence through self-determined informal learning outside the classroom. For our last hypothesis, we therefore expect that the association between low autonomy (in terms of the teacher providing choices) and low perceived competence is less pronounced for students with higher use of non-academic English-language ICTs (H4). Put differently, we expect that using ICTs more often in one's free time enhances the positive association between autonomy and competence.

2. Materials and Methods

2.1. Sample and Procedure

In our preregistered study (https://osf.io/tvnk2, accessed on 25 November 2023), we used data from three of four waves from a larger longitudinal research project ("Identification of school success factors", https://osf.io/ucvh5/, accessed on 25 November 2023) that aimed to identify the relative importance of various success factors for grades on the graduation exam in Austrian secondary schools of the highest track (Gymnasium). The project was conducted together with the Austrian Federal Ministry of Education, Science, and Research.

In Austria, secondary education starts after four years of elementary education, usually when students are around the age of 10, and is divided into a lower and an upper phase. Lower secondary education concludes with grade 8, after which students in academic-track schools can decide to continue with upper secondary education or leave the academic-track school to enroll in a vocational school that provides more specialized career preparation. Upper secondary education concludes with a standardized exam (Matura) in grade 12, which, when passed, enables students to enroll at university. About 36% of Austrian students enroll in a Gymnasium after elementary school, and around 29% decide to stay there after grade 8 [41].

As there are approximately 270 public general secondary schools of the highest track in Austria, the 30 Austrian Gymnasium schools recruited for this project provide a representative sample at the school level. Additionally, the sample provides enough power to consider the class level and conduct multilevel SEMs. Schools were recruited by the Austrian Federal Ministry of Education, Science, and Research and received a project report with school-specific results as thanks for their participation. More details about the sampling procedure can be found in the preregistration of the project this study draws its data from. Students were in grade 11 at wave one (May 2022) and in grade 12 in the consecutive waves (September/October 2022, March/April 2023, May/June 2023).

In waves one to three, participants responded to an online survey, which was filled out during a regular classroom lesson, supervised by trained research assistants. On the first page of the online questionnaire, students received information about the voluntariness and anonymity of their participation, provided written informed consent, and were asked for permission for data processing. If this permission was not given, the questionnaire ended. Filling out the questionnaires took on average 25 min in waves one and two, and around 10 min in wave three, depending on the reading speed of the students. This study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved

by the Ethics Committee of the University of Vienna (00724). In total, 1912 students filled out the questionnaires in at least one data collection wave.

To be considered for the present study, three inclusion criteria had to be met: (1) Students had to have stated the intention to take the written graduation exam (Matura) in English. Participants who did not plan to take the exam or for whom this information was missing were excluded from this study (n = 326). (2) Students who did not state which English class and therefore which teacher they belonged to (n = 39) could not be considered for this study. (3) Students who experienced a change in their learning context (e.g., a change in English group or English teacher) over the course of the data collection waves were excluded from the sample (n = 300), as a change in learning context could have an impact on the outcome variables.

The final sample consisted of 1288 students (mean age at wave 1 = 17.11 years, SD = 0.71, 56.29% female) from 92 English classes. The number of students per English class ranged from 2 to 25 (M = 14, SD = 3.91).

2.2. Measures

The items referred to the subject English as a foreign language and to the class's English teacher. Responses were given on a 5-point Likert scale ranging from 1 to 5 for the scales assessing competence, intrinsic motivation, grade aspiration, and perceived autonomy support. Use of non-academic ICTs was assessed as a formative measure, with answers ranging from 0 to 4.

2.2.1. Perceived Autonomy Support

Students' perceived autonomy support was measured with two scales in wave one. The scale for providing choices used five items based on Jäger et al. (2012; [42]), Baumert et al. (2008; [43]), and Lüftenegger et al. (2017; [44]) and showed sufficient reliability (ω = 0.72; sample item: "In English class, we can decide for ourselves how to work on tasks."/"Im Englisch-Unterricht können wir selbst wählen, wie wir Aufgaben bearbeiten wollen."). Answers ranged from 1 (not true at all) to 5 (totally true). Students' perception of constructive support by the teacher was measured with 5 items from Fauth (2021; [45]) and showed good reliability (ω = 0.79; sample item: "Our English teacher tells me how to do better when I have made a mistake."/"Unsere Englisch-Lehrkraft, sagt mir, wie ich es besser machen kann, wenn ich einen Fehler gemacht habe."). Answers ranged from 1 (never) to 5 (always).

2.2.2. Perceived Competence

We measured students' perceived competence in wave two with a four-item scale that assessed the students' domain-specific academic self-concept in the subject of English [46] (ω = 0.86; sample item: "I learn quickly in English."/"In Englisch lerne ich schnell."). Answers were given on a scale ranging from 1 (not true at all) to 5 (totally true).

2.2.3. Non-Academic ICTs

To assess students' use of non-academic English-language ICTs, we asked them to state how often they usually engaged with four different types of ICTs in their free time (wave two). The ICTs assessed were as follows: movies and TV shows (e.g., Netflix, BBC, or at the cinema, based on Porsch, 2010; [47]), videos and clips (e.g., on YouTube or TikTok, based on Sargsyan and Kurghinyan, 2016; [48]), gaming (e.g., playing video games in English, based on [47]), and online communication (e.g., blogs, e-mails, or social media, based on Zhang, 2021; [49]). Answers ranged from 0 (never) to 4 (very often) and were summed up to build a score per individual. Non-academic ICT use was included as a moderator for the path from autonomy (in terms of provided choices) to the mediator competence in our model.

2.2.4. Motivational Outcomes

Students' motivational outcomes were assessed in wave three. To measure students' intrinsic motivation, we used three items from Gaspard et al. (2022; [50]) (3 items, ω = 0.93, sample item: "I simply like English."/"Englisch mag ich einfach."), with answers ranging from 1 (not true at all) to 5 (totally true). To assess grade aspirations on the graduation exam, we asked students which grade they would like to achieve in the written exam (single item). In Austria, grades range from 1 to 5, with 1 ("very good") being the best grade, 4 ("sufficient") being the minimum to pass the exam, and 5 ("insufficient") being the worst grade, with which students fail the exam. For the analyses, we recoded the values so that higher values indicate a higher aspired grade.

2.3. Analyses

Analyses were conducted using confirmatory factor analyses (CFAs) and structural equation models (SEMs) in Mplus 8.7 [51]. Given the multilevel nature of classroom data, we used the complex design option implemented in Mplus for CFAs while specifying the main models as two-level models. To deal with missing values (between 8.85% and 22.21% on the item level), we applied the full information maximum likelihood approach implemented in Mplus for CFAs. For the main models, we used Bayesian estimation to deal with missing values in all variables.

In preliminary analyses, we calculated CFAs to assess the dimensionality of the autonomy support scales (choices, constructive support), intrinsic motivation, and competence using the robust maximum likelihood estimator (MLR). We assessed the goodness of fit for all models using the comparative fit index (*CFI*), Tucker–Lewis index (*TLI*), the root mean square error of approximation (*RMSEA*), and the standardized root mean square residual (*SRMR*). We followed the guidelines suggested by Hu and Bentler (1999; [52]) regarding cutoff scores for excellent and adequate fit to the data, respectively: *CFI* and *TLI* > 0.95 and 0.90; *RMSEA* and *SRMR* < 0.06 and 0.08. We further tested for gender differences in the mediator and outcome variables, as in the literature, it is consistently shown that in secondary education, girls might have an advantage in and higher intrinsic motivation for language learning than boys [39,53].

To answer our research questions, we estimated a multivariate two-level moderated mediator model (see Figure S1). We relied on the common convention to select three values of the moderator, where the mean represents a medium level of ICT use, whereas one standard deviation above and below the mean represent high and low levels of ICT use, respectively [54]. To account for the complexity of calculations and to facilitate the interpretation of results, we calculated five models with a stepwise approach: a mediated model with only the predictor constructive support (M1); a mediated model with only the predictor providing choices (M2); a moderated mediation model with only the predictor providing choices (M3); a mediation model with both predictors, but without the moderator (M4); and the full moderated mediation model (M5). We chose the Bayesian Markov Chain Monte Carlo (MCMC) estimation method to deal with missing data, because bootstrapping in conjunction with multilevel modeling is not available in Mplus 8.7. Eight chains were requested for the Gibbs sampler, which divides the parameters and the latent variables into groups that are conditionally and sequentially generated [51], and we specified a minimum number of 10,000 iterations. Convergence was assessed by carefully examining trace plots for every parameter as well as with the Posterior Scale Reduction criterion, reaching a value less than 1.05. For prior distribution, we used the program's default settings of non-informative priors. Since we were only interested in the students' subjective perception of their classrooms and not of more objective classroom climate effects [55], the models were specified solely on the individual level, as our only aim was to control for hierarchical data structure. At the individual level, all variables were group-mean centered.

3. Results

3.1. Preliminary Results

Table 1 provides bivariate two-level latent correlations between all variables as well as descriptive statistics and composite reliabilities of the scales. Preliminary analyses revealed no significant gender differences for intrinsic motivation (t(1167) = −1.26, $p = 0.115$), grade aspirations (t(658) = 0.347, $p = 0.364$), and perceived competence (t(1075) = −0.64, $p = 0.261$). Intraclass correlation coefficients (*ICCs*) were high for constructive support, providing choices, and grade aspirations, indicating a high level of variance between classrooms and calling for the employment of a multilevel approach. CFA models showed that all scales provided a sufficient-to-excellent level of fit to the data (see Table 2).

Table 1. Bivariate latent correlations, descriptive statistics, and reliabilities.

	1	2	3	4	5	6
1. Constructive support	-					
2. Providing choices	0.661 *	-				
3. Competence	0.263 *	0.116 *	-			
4. Intrinsic motivation	0.292 *	0.169 *	0.623 *	-		
5. Aspirations	0.244 *	0.068	0.614 *	0.496 *	-	
6. ICTs	0.126 *	0.119 *	0.506 *	0.451 *	0.337 *	-
Number of items	5	5	4	3	1	4
Theoretical range	1–5	1–5	1–5	1–5	1–5	0–16
M	3.37	2.36	3.77	3.74	4.07	9.59
SD	0.86	0.76	0.89	1.05	0.96	3.19
Skewness	−0.28	0.38	−0.41	−0.62	−0.65	−0.07
Kurtosis	−0.39	−0.23	−0.47	−0.32	−0.63	−0.40
Minimum	1.00	1.00	1.00	1.00	1.00	0.00
Maximum	5.00	5.00	5.00	5.00	5.00	16.00
Omega (composite reliability)	0.785	0.723	0.857	0.930	-	-
ICC	0.192	0.236	0.057	0.072	0.106	0.050

Note. Correlation coefficients are reported on the within level. ICTs = information and communication technologies; ICC = intra-class correlation coefficient (proportion of between-classroom variance in total variance). * *All estimates are at least statistically significant at the p < 0.01 level.*

Table 2. Model fit for multilevel confirmatory factor analyses.

Model	χ^2	df	RMSEA	CFI	TLI	SRMR
Providing choices	40.204 *	10	0.054	0.961	0.922	0.027
Constructive support	39.693 *	10	0.053	0.973	0.946	0.033
Competence	78.579 *	4	0.126	0.961	0.884	0.019
Intrinsic motivation	0.000 *	0	0.000	1.000	1.000	0.000

Note. χ^2 = chi square test of model fit; RMSEA = root mean square error of approximation; CFI = comparative fit index; TLI = Tucker–Lewis index; SRMR = standardized root mean squared residual. Intrinsic motivation only has three manifest indicators; therefore, no model fit indices are reported. * *All estimates are at least statistically significant at the p < 0.01 level.*

3.2. Main Results

To answer our research questions, we fit several models that built upon each other (see Table 3). The "support model" and "choice model" include only the predictors constructive support and providing choices, respectively, the mediator competence, and both outcome variables. The "choice model (moderated)" includes the predictor providing choices, the mediator competence, as well as the moderator variable ICTs, which was added as a latent interaction between providing choices and ICTs (choices × ICTs). The "mediator model" includes both predictors, the mediator and both outcome variables, but no moderation. Lastly, the moderated mediation model is the full model, including all paths. Results are reported with respect to the hypothesis under investigation.

Table 3. Path coefficients of multilevel predictive models.

Effect	Support Model		Choice Model		Choice Model (Moderated)		Mediator Model		Moderated Mediation Model	
	Est. (S.D.)	Std.	Est. (S.D.)	Std.	Est. (S.D.)	Std.	Est. (S.D.)	Std.	Est. (S.D.)	Std.
CH → COMP			0.155 * (0.060)	0.107	0.088 (0.055)	0.059	−0.150 (0.086)	−0.111	−0.156 * (0.078)	−0.116
CH → MOT			0.144 * (0.061)	0.092	0.187 * (0.064)	0.117	0.045 (0.086)	0.031	0.108 (0.088)	0.075
CH → ASP			−0.037 (0.054)	−0.025	−0.010 (0.056)	−0.007	−0.201 * (0.078)	−0.145	−0.154 * (0.079)	−0.113
SUPP → COMP	0.341 * (0.050)	0.281					0.410 * (0.075)	0.347	0.344 * (0.068)	0.288
SUPP → MOT	0.166 * (0.050)	0.127					0.134 (0.077)	0.105	0.107 (0.079)	0.082
SUPP → ASP	0.126 * (0.045)	0.101					0.238 * (0.068)	0.196	0.216 * (0.070)	0.177
COMP → MOT	0.610 * (0.037)	0.566	0.638 * (0.035)	0.592	0.651 * (0.036)	0.602	0.614 * (0.038)	0.570	0.632 * (0.038)	0.584
COMP → ASP	0.577 * (0.033)	0.560	0.608 * (0.032)	0.591	0.608 * (0.032)	0.596	0.566 * (0.034)	0.550	0.571 * (0.034)	0.560
ICTs → COMP					0.141 * (0.008)	0.496			0.136 * (0.008)	0.479
Indirect effects										
CH → MOT			0.099 * (0.038)	0.072			−0.092 (0.053)	−0.067		
CH → ASP			0.094 * (0.037)	0.074			−0.084 (0.048)	−0.067		
SUPP → MOT	0.207 * (0.032)	0.170					0.251 * (0.048)	0.206	0.217 * (0.045)	0.178
SUPP → ASP	0.196 * (0.030)	0.176					0.231 * (0.043)	0.207	0.196 * (0.039)	0.176
Moderated effects										
CH × ICTs → COMP					−0.032 (0.017)	−0.065			−0.032 * (0.015)	−0.072
Low ICTs × CH → COMP → MOT					−0.076 (0.075)				−0.227 * (0.075)	
Med ICTs × CH → COMP → MOT					−0.142 (0.108)				−0.292 * (0.100)	
High ICTs × CH → COMP → MOT					−0.208 (0.142)				−0.356 * (0.127)	
Low ICTs × CH → COMP → ASP					−0.071 (0.070)				−0.205 * (0.067)	
Med ICTs × CH → COMP → ASP					−0.133 (0.101)				−0.264 * (0.089)	
High ICTs × CH → COMP → ASP					−0.195 (0.133)				−0.322 * (0.113)	

Note. Est. = unstandardized parameter estimates; S.D. = Bayesian Posterior Standard Deviation; Std. = standardized parameter estimates, CH = providing choices, SUPP = support, COMP = competence, MOT = intrinsic motivation, ASP = aspirations, ICTs = Information and communication technologies. * = significant effect.

3.2.1. Autonomy-Supportive Teaching and Competence

Both models with only one predictor (support model and choice model) revealed statistically significant positive associations between autonomy-supportive teaching strategies and students' perceived competence (support: *standardized b* = 0.281, *Posterior SD* = 0.037; providing choices: *b* = 0.107, *P.SD* = 0.041). Adding ICTs as a moderating variable to the choice model (moderated) changed the positive association between providing choices and perceived competence to statistically non-significant.

When both predictors but no moderator were included (mediator model), we again found a statistically significant positive association between support and competence (*b* = 0.347, *P.SD* = 0.059). However, treating support as a constant changed the association between providing choices and competence to become non-significant and negative.

In the full moderated mediation model, support showed a statistically significant positive association with competence (*b* = 0.288, *P.SD* = 0.054), replicating the results of all former models. Adding ICTs as moderator into the full model and controlling for the effect of support, however, revealed a statistically significant negative association between providing choices and perceived competence (*b* = −0.116, *P.SD* = 0.057).

3.2.2. Competence Perception and Motivation

Both models containing only one predictor revealed statistically significant positive associations between perceived competence and students' intrinsic motivation (support model: *b* = 0.560, *P.SD* = 0.026; choice model: *b* = 0.592, *P.SD* = 0.025) and grade aspirations (support model: *b* = 0.560, *P.SD* = 0.026; choice model: *b* = 0.591, *P.SD* = 0.024). This was also the case when we included ICTs as a moderator in the choice model (intrinsic motivation: *b* = 0.602, *P.SD* = 0.025; grade aspirations: *b* = 0.596, *P.SD* = 0.024).

In the mediator model that contained both predictors but no moderation the association between competence and both outcomes stayed positive and significant (intrinsic motivation: *b* = 0.570, *P.SD* = 0.028; aspirations: *b* = 0.550, *P.SD* = 0.028). Also in the full moderated mediation model, the associations stayed statistically significant and positive (intrinsic motivation: *b* = 0.584, *P.SD* = 0.028; grade aspirations: *b* = 0.560, *P.SD* = 0.027), replicating the results from all former, less complex models.

3.2.3. Autonomy-Supportive Teaching and Motivation

Both separate models revealed positive and statistically significant associations between autonomy-supportive teaching strategies and intrinsic motivation (support model: *b* = 0.127, *P.SD* = 0.037; choice model: *b* = 0.092, *P.SD* = 0.038). The association with grade aspirations was only found to be statistically significant in the support model (*b* = 101, *P.SD* = 0.035). Indirect effects for both strategies were also found to be positive and statistically significant for intrinsic motivation (support model: *b* = 0.170, *P.SD* = 0.026; choice model: *b* = 0.072, *P.SD* = 0.028) and grade aspirations (support model: *b* = 0.176, *P.SD* = 0.027; choice model: *b* = 0.074, *P.SD* = 0.029). When including ICTs as a moderator (moderated choice model), the association between providing choices and intrinsic motivation stayed positive and statistically significant (*b* = 0.117, *P.SD* = 0.039), while the non-significant positive association between providing choices and aspirations became negative. Indirect conditional effects for both outcome variables were also negative and non-significant for all levels of ICT use.

In the mediation model that contained both predictors but no moderation we found statistically significant associations between constructive support and grade aspirations (*b* = 0.196, *P.SD* = 0.055), which is in line with the separate support model, but controlling for the effect of choices, the relation between support and intrinsic motivation became non-significant. As in the support model, the indirect effects of support on both outcomes were statistically significant and positive (intrinsic motivation: *b* = 0.206, *P.SD* = 0.039; grade aspirations: *b* = 0.207, *P.SD* = 0.039). However, controlling for the effect of constructive support changed several associations of the predictor providing choices. (a) While

providing choices had a significant positive effect on intrinsic motivation when assessed alone, including support in the model turned the effect non-significant. (b) While the effect of providing choices on aspirations was non-significant in both separate choice models, including support turned the association statistically significant (b = 0.145, *P.SD* = 0.056). (c) Even though the indirect effects of choices on both outcome variables stayed statistically non-significant, the associations became negative.

Lastly, examining the results from the full moderated mediation model, we found that in concert with the mediation model, autonomy-supportive teaching strategies were significantly positively associated with aspirations (support: b = 0.177, *P.SD* = 0.057; choices: b = 0.113, *P.SD* = 0.057), but not with intrinsic motivation. Also, indirect effects of support via competence remained statistically significant and positive for both outcomes (intrinsic motivation: b = 0.178, *P.SD* = 0.037; grade aspirations; b = 0.176; *P.SD* = 0.035), while the indirect effects of providing choices on both outcomes were significant, negative, and varied with the level of ICT use (see Table 3).

3.2.4. Moderation of Non-Academic ICTs

In both models containing the moderator (choice model moderated, moderated mediation model), we found statistically significant positive direct effects of the moderator ICTs on the mediator competence (choice model moderated: b = 0.496, *P.SD* = 0.024; moderated mediation model: b = 0.479, *P.SD* = 0.025).

However, in the choice model moderated, we found no significant interaction between ICTs and choice, and no significant indirect effects via competence on the outcome variables intrinsic motivation and aspirations. This changed when we added support as a second predictor. In the full moderated mediation model (Figure 1), we found a statistically significant positive latent interaction effect of providing choices and ICTs on competence (b = 0.072, *P.SD* = 0.033). Regarding the indirect conditional effects of providing choices on both outcomes, the results showed that with increasing ICT use, the negative association between providing choices and both outcomes (descriptively) became stronger. Johnson–Neyman plots and simple slope plots depicting the interaction between choices and ICT use are provided within Figures S2–S7 (Supporting Information).

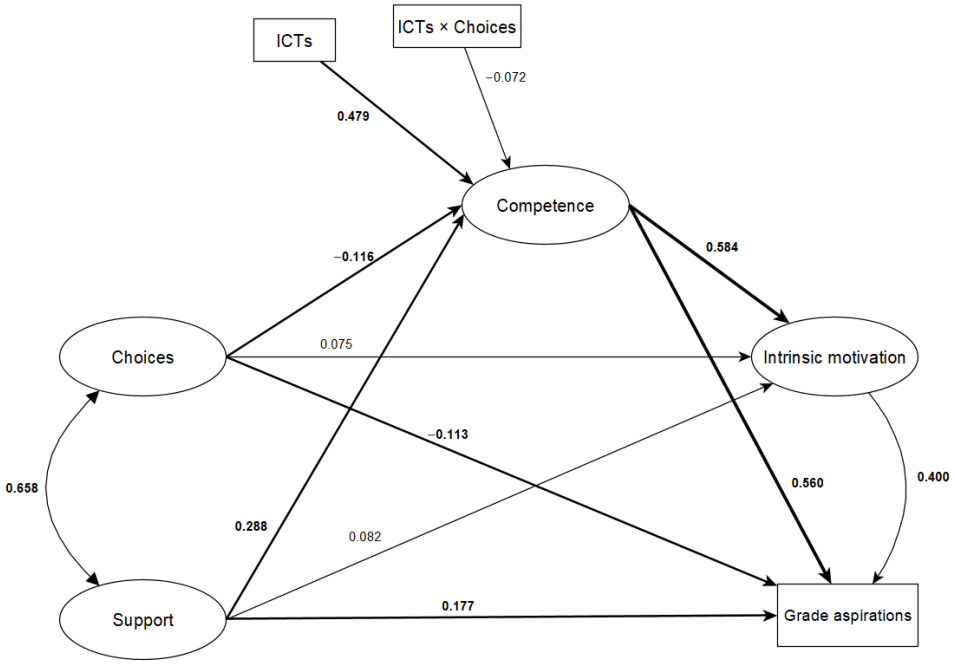

Figure 1. Results of the full moderated mediation model. Reported values are standardized coefficients. Values and arrows in boldface represent statistically significant results.

4. Discussion

The present study aimed to examine how self-determined informal learning via non-academic English-language ICTs in students' free time moderates the association between an autonomy-supportive classroom and students' motivation. In our longitudinal study with three measurement waves, students reported their perception of two aspects of their English teacher's autonomy-supportive teaching style (providing choices and constructive support), as well as their own perceived competence, intrinsic motivation, grade aspirations in English for their graduation exam, and their non-academic English-language ICT use in their free time.

4.1. Relations between Perceived Autonomy-Supportive Teaching and Competence

Regarding direct effects, we expected a classroom that fosters students' autonomy to be a prerequisite for developing a sense of competence. As hypothesized, we found that an autonomy-supportive teaching style that focuses on constructively working with students (constructive support) to help them with their learning progress—by encouraging them when they face difficulties during tasks or providing them with feedback on what they already know and what they still have to learn—positively predicted students' perceived competence (H1b). Even though the effects in all models were small-to-medium in size, they demonstrate the importance of supportive teachers for students to develop a healthy level of perceived competence in school. We also found that adolescents' perceived autonomy in the classroom—in terms of their teachers providing them with choices to jointly shape lessons—positively affected their perceived competence when observed alone, supporting H1a.

However, when we included both examined facets of autonomy-supportive teaching in the models, the effect of a student-focused teaching style on perceived competence became negative. Whereas this result might seem counterintuitive at first glance (especially when considering the positive correlation between these two constructs), it is important to remember that within multivariate regression, the effect of one predictor is the influence of that variable while all other predictors are held constant. Interpreting the effect of providing choices accordingly indicates that autonomy per se is something desirable in the classroom, but students need support in their autonomy. If a teacher increases the amount of students' choices during learning—what they want to learn, how they would like to work—but not the amount of constructive support, students might feel overwhelmed with tasks, which then damages their perceived competence. This notion is supported by the consideration that perceived competence depends on the balance between the challenge of and the skill required for completing a task. As Cerasoli et al. (2016; [56]) describe, an individual's perceived competence can only develop if their skills are sufficiently high to just match the challenge of the task. If, however, the challenge considerably exceeds their existing skills, an individual will feel overchallenged and overwhelmed, leading to a loss of perceived competence. However, it is important to note that throughout all models, the effects of providing choices on competence were either non-significant or—in the moderated mediation model—quite small and hence do not allow for strong implications for interventions or school practice.

4.2. Relationships between Perceived Competence and Motivation

Consistently with the current literature and H2a, we found that perceived competence strongly predicted students' intrinsic motivation [5,13,14]. For the association between competence and grade aspirations, the picture in the literature is less clear, but our results suggest that perceived competence is also a strong predictor of this more extrinsic type of motivation, supporting H2b. Self-determination theory subdivides extrinsic motivation into four distinct types that "vary in the degree to which they are experienced as autonomous" [7]. With regards to grade aspirations, it is unclear what processes led students to strive for that specific grade. Their goal to receive a good grade might have formed due to pressure from their parents [57,58], which would represent the least autonomous type of

extrinsic motivation ("external regulation") [7], but it might also have developed because the student found English to be an important language for communicating with people from different backgrounds, hence representing a much more autonomous type of extrinsic motivation ("integrated regulation"). Understanding these differences might also provide promising explanatory approaches as to why a person is more or less inclined to life-long learning and openness to necessary change.

In our study, when we asked students about their grade aspirations in English on the written graduation exam, most students may have anticipated this language to be an important prerequisite for their future jobs, studies, or personal lives, which would make the extrinsically defined grade aspirations into a more intrinsic type of motivation. This in turn might explain the strong association between perceived competence and grade aspirations found in this study. Future research should focus on how personal grade aspirations are formed in the first place and to distinguish more autonomous types of this measure from purely extrinsic ones.

4.3. Mediated Relations between Autonomy-Supportive Teaching and Motivation

We hypothesized that the effects of autonomy in the classroom via providing choices and constructive support would positively predict intrinsic motivation and grade aspirations, mediated by perceived competence. Indeed, our results showed that competence mediated the positive effect of constructive support on both motivational outcomes in all models (H3c, H3d), and the association even (descriptively) increased when autonomy in terms of providing choices was added as a second predictor (and hence, held constant). These findings highlight the importance of feedback during the learning process. They suggest that a teacher who fosters an encouraging teaching style, providing information about what students already know and what they still have to learn, helps them develop a healthy level of perceived competence, which in turn positively influences their motivation. Considering the interplay between providing choices and constructive support, it seems like more support from the teacher helps students strive for higher grades, as they can better estimate their ability to achieve the desired grade, regardless of how autonomously they can learn in the classroom. This is in line with the literature (especially concerning expectancy-value theory [15]), which posits that aspirations are dependent on perceived competence [28,29].

For providing choices, however, the indirect effects on both motivational outcomes were negative, only statistically significant when we included ICTs as a moderator, and they increased in magnitude with increasing ICT use. These results were contrary to what we expected (H3a, H3b).

4.4. The Role of Non-Academic ICTs in the Relationship between Autonomy-Supportive Teaching, Competence, and Motivation

Regarding the effect of ICTs on perceived competence, we expected that use of non-academic English-language ICTs in the students' free time would strengthen the positive relationship between the teacher providing choices and the students' perceived competence (H4). ICTs positively predicted confidence in the subject English as a foreign language, but, as described above, providing choices in the classroom was negatively related to competence when support was held constant. Furthermore, contrary to what we hypothesized, an increasing use of ICTs also increased the negative relationship between autonomy in the classroom and competence. This means that, when comparing students who perceive the same amount of autonomy in their classroom, a student who uses ICTs more will feel less competent in school. Put differently, when a student spends more time on ICTs but experiences no increase in autonomy in the classroom, the student will feel less competent in school. Our data show that this in turn also negatively influences students' intrinsic motivation and grade aspirations. Several explanations for this seem plausible.

On the one hand, it might be that an autonomy-supporting classroom—where the teacher asks students to suggest topics of interest—motivates students to search for more

topics in their free time [59]. However, instructional time is restricted, making it impossible to incorporate all topics, so even though ICT use increases, autonomy in the classroom may not. Students are then faced with the challenge of engaging with topics of interest on their own, without support. As our data showed, increasing autonomy in the classroom with stable constructive support negatively affected perceived competence, suggesting that students might become overwhelmed with the information or complexity of certain topics, or face difficulties with understanding all aspects of it. Further, it is possible that students feel competent in their school-level English in general, but when engaging with content not taught in school, they might realize that their "real-world" level of English deviates from their school-level English. This realization might lead to a generalization to school-related perceived competence.

Lastly, it might be that students who use more English-language ICTs generally spend more time with ICTs in their free time, which would reduce the time they have for completing homework or studying on their own. Thinking further, these students might use ICTs more often not only outside, but also inside the school. As mobile phones are usually not prohibited in class in Austrian schools, students with high levels of ICT use might use their phones more often during lessons, leaving them distracted, which in turn could negatively affect their perceived competence because they might miss important information that would help them understand the learning content. Unfortunately, in our study, we did not assess how often students used their phones for non-academic purposes in class, even though Sanfo (2023) showed that increased use of non-academic ICTs during class has a negative impact on learning outcomes [33].

Regarding the main focus of our paper, it would be interesting to examine how non-academic English-language ICTs influence other aspects of perceived competence, such as language use self-efficacy. A negative relationship would strengthen the notion that heightened autonomy in the classroom without increasing constructive support for engaging with English in students' free time influences not only students' "real-world competence" but is generalized to school-perceived competence as well.

4.5. Strengths, Limitations, and Future Directions

The present study used a longitudinal design and a large representative sample to add to the still-scarce body of literature bridging SDT and language learning. By including students' ICT use outside of school, we started to tackle an important gap, examining the influence of leisure activity on school-related outcomes. Further, by including two facets of autonomy-supportive teaching, we were able to show that different aspects of this construct influence each other, and that basic need satisfaction is not a simple "yes-or-no" question, but rather a question of individualized balance for each student. This is of great practical relevance, as interventions in school normally focus on the whole classroom, even though when considering the actual people in the classroom, it is highly unrealistic that one intervention fits all.

Despite these noteworthy strengths, several limitations of our study also need to be addressed. First, even though we included two distinct aspects of autonomy support based on a common conceptualization [18–21], the literature suggests that this distinction might not be exhaustive or sufficient [22]. Future studies might want to expand the concept of autonomy-supportive teaching, following the example of Flunger et al. (2022; [25]). Further, measuring all variables in all waves within our longitudinal design would have enabled us to examine between-person differences in within-person change in perceived autonomy-supportive teaching using growth-curve modeling or to uncover within-person reciprocal processes using (random) cross-lagged panel models. Third, aspirations for the graduation exam were measured with a single item. Even though single items have been shown to provide valid empirical data for several outcomes in the educational field [60], we are aware that this operationalization may not capture all facets of students' academic aspirations. Considering the conceptualization of extrinsic motivation in self-determination theory, aspirations with regard to a specific grade can vary in the degree to which they are

experienced as autonomous [7]. Especially when it comes to English language learning, students might form their achievement aspirations in a more autonomous way, as the language is of great practical relevance in our daily lives: as a world language, it is present in almost all university degree programs and job descriptions, and is extremely useful for personal travel. Future studies might want to include a measure of the antecedents of students' aspirations to differentiate between more intrinsic and extrinsically motivated aspirations, as well as using multiple items for measuring aspirations. Lastly, regarding the use of ICTs, researchers need to incorporate a measure of how often students get distracted by using them during class when they should not. ICTs can be a useful tool for language learning, as the internet provides learners with a multitude of learning possibilities, topics, content, and applications, but they can also be a distraction when the focus should be centered on the ongoing lesson. This is especially true for social media and online communication. It is likely that students who use more non-academic ICTs in their free time are also more prone to using these tools as a distraction during class when they are tired, bored, or frustrated, or even because they experience withdrawal symptoms. Conducting studies that examine the use of non-academic ICTs outside and inside the school would help to expand our understanding of the complex processes that students face while learning in school.

5. Conclusions

Our results highlight the importance of examining several aspects of autonomy-supportive teaching and of providing a balance in the fulfillment of students' basic needs in the classroom. Also, our results show how important it is to include variables from outside the school, because non-academic ICT use outside the school also influences school-related competence and, mediated by that, motivational outcomes.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su16031337/s1, Figure S1: Assumed model. Figure S2: Johnson–Neyman plot for the moderated effect of autonomy on competence (autonomy model); Figure S3: Johnson–Neyman plot for the moderated effect of autonomy on competence (moderated mediation model); Figure S4: Simple slope plot for conditional indirect effect of different ICT usage (low, medium, high) and autonomy via competence (autonomy model, effect on intrinsic motivation); Figure S5: Simple slope plot for conditional indirect effect of different ICT usage (low, medium, high) and autonomy via competence (autonomy model, effect on grade aspirations); Figure S6: Simple slope plot for conditional indirect effect of low, medium, and high ICT usage and autonomy via competence (moderated mediation model, effect on intrinsic motivation); Figure S7: Simple slope plot for conditional indirect effect of different ICT usage (low, medium, high) and autonomy via competence (moderated mediation model, effect on aspirations).

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