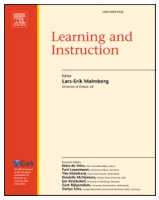
Learning and Instruction 92 (2024) 101910

Contents lists available at ScienceDirect

Learning and Instruction

journal homepage: www.elsevier.com/locate/learninstruc



What is the role of teaching support in students' motivation and engagement trajectories during adolescence? A four-year latent growth modeling study

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ARTICLE INFO

Keywords
Teaching support
Educational transition
Motivation
Engagement
Achievement

ABSTRACT

Background and aims: This 4-wave longitudinal study investigated the role of perceived teaching support in motivation and engagement trajectories from early adolescence in Year 6 (Time 1) to mid-adolescence in Year 9 (Time 4).
Sample: A total of 7769 Australian school students participated.
Methods: Latent growth modeling (LGM) was implemented to explore students' trajectories.
Results: Findings confirmed the well-known pattern of motivation and engagement declines from early to mid-adolescence—but the role of perceived teaching support played a significant part in how these patterns of motivation and engagement unfolded. Specifically, we found evidence for: (1) temporal effects, such that motivation and engagement declined over time; (2) initiating effects, such that perceived teaching support at Time 1 was associated with positive "starting points" for motivation and engagement at Time 1; (3) contemporaneous effects, such that for at least one timepoint, perceived teaching support was related to positive motivation and engagement at the same timepoint; (4) sustaining effects, such that perceived teaching support significantly predicted positive motivation and engagement at all four timepoints; and (5) escalating effects, such that the predictive role of perceived teaching support on students' motivation and engagement increased over time.
Conclusion: Findings contribute to knowledge about how to boost and sustain the motivation and engagement trajectories of students during early to mid-adolescence.

1. Introduction

The academic journey from early to mid-adolescence is a challenging one for many students (Benner, Boyle, & Bakhtiari, 2017; Evans, Borriello, & Field, 2018). However, if they are well supported during this time, there is a heightened likelihood they will go on to experience positive outcomes in late adolescence and beyond (Kiuru et al., 2020). As we describe below, numerous theories identify salient contextual factors that impact human development over time—including adolescents' academic development. Informed by key tenets of these theories, the present investigation applied latent growth modeling (LGM) to examine the role of perceived teaching support in adolescents' motivation and engagement trajectories over the course of 4 years at school. Perceived teaching support refers to students' perceptions of the assistance, instruction, and resources provided by teachers to support their learning (Wong, Tao, & Konishi, 2018) and in this study is hypothesized as a key factor associated with adolescents' academic development. The study comprised data collected each year from Year 6 (Time 1; final year of primary/elementary school) to Year 9 (Time 4; middle of high school) which enabled a focus on early to mid-adolescent development (World Health Organization, 2023) and captured a major educational transition, from primary school to high school. Fig. 1 demonstrates the model we examined and that enabled us to unpack in quite precise terms when and how perceived teaching support is related to longitudinal patterns of motivation and engagement during adolescence. In line with the focus of the Special Issue, the study sought to integrate major theorizing with

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https://doi.org/10.1016/j.learninstruc.2024.101910
Received 26 July 2023; Received in revised form 6 March 2024; Accepted 20 March 2024
Available online 11 April 2024

novel approaches to longitudinal data to build more appropriate developmental models that inform educators' approaches to optimizing adolescents' motivation and engagement trajectories.

2. Motivation and engagement trajectories during adolescence

According to Eccles, Wigfield, and Byrnes (2003), there is a disconnect between the developmental needs of adolescents and the nature of tasks, assessment regimes, and motivational strategies at school. This disconnect has been cited as a major reason adolescents can struggle academically over this time (Eccles et al., 2003). Indeed, for several decades, researchers have demonstrated declines in students' expectancies, perceived academic competence, valuing, engagement, and other psycho-social factors from early to mid-adolescence (e.g., Burns et al., 2019; Burns et al., 2019; Evans et al., 2018; Fredricks & Eccles, 2002; Martin, Way, Bobis, & Anderson, 2015). To the extent there are shifting motivation and engagement trajectories spanning this developmental period, researchers ought to consider factors that might support students during this time. The present study investigated the role of perceived teaching support in contributing to students' motivation and engagement trajectories from early to mid-adolescence. Indeed, because there are school factors that impact adolescents' motivation and engagement trajectories (Eccles et al., 2003), attending to a positive and modifiable aspect of school—teaching support—makes empirical and practical sense and is supported by other research attesting to the significant role of teaching support in students' academic development (e.g., Downer, Sabol, & Hamre, 2010; Rimm-Kaufman, Baroody, Larsen, Curby, & Abry, 2015). LGM was used to assess the role of teaching support in these trajectories in terms of six potential effects that rarely receive conjoint attention: temporal, initiating, slope, contemporaneous, sustaining, and escalating effects (Burns, Bostwick, et al., 2019). Although it is well known that teaching support is significantly associated with students' motivation and engagement (e.g., Downer et al., 2010; Rimm-Kaufman et al., 2015), our focus on these hypothesized effects enables a novel and much closer understanding of exactly how teachers impact their students' academic development.

Temporal effects occur when motivation and engagement increase or decrease over time. Research summarized above has demonstrated that motivation and engagement decline and so interest then turns to factors that may address this decline (perceived teaching support in the present study). Initiating effects occur when perceived teaching support at the first timepoint of modeling (Year 6, Time 1) predicts higher levels of motivation and engagement at this (initial) timepoint. *Slope effects* occur when perceived teaching support at the first timepoint is associated with an easing (or escalation) of the well-known declines in students' motivation and engagement across the four timepoints (Year 6, Time 1 to Year 9, Time 4). Finding initiating and/or slope effects would underscore the importance of quality teaching support early in adolescence. *Contemporaneous effects* occur when perceived teaching support at one timepoint is associated with higher levels of motivation and engagement for the matching timepoint (e.g., perceived teaching support at Time 2 is associated with higher motivation and engagement at Time 2). Finding a significant contemporaneous effect means that quality teaching support is linked to students' motivation and engagement at each time it is implemented (not just the first timepoint of modeling, as is indicated by an initiating effect). *Sustaining effects* occur when significant contemporaneous effects take place at all four timepoints. Such a finding would speak powerfully to the ongoing importance of teaching support through adolescents' academic lives. Taking sustaining effects a step further, escalating effects occur when the size of the effect for perceived teaching support on motivation and engagement increases across time. The implication of finding a significant escalating effect is that students come increasingly into their teacher's orbit the further into adolescence they progress—and this is empowering for educators as it is often assumed adolescence is a time when the influence of adults declines (Lam, McHale, & Crouter, 2014).

Investigating these six effects is a novel way to unpack theorized processes implicated in adolescents' motivation and engagement trajectories. For example, Skinner, Zimmer-Gembeck, and Connell (1998; see also Collie & Martin, 2023; Rickert & Skinner, 2022) suggested that adolescents' academic development can be characterized by two processes: a launch process and change-to-change process. The launch process holds that trajectories are established by early experiences and individual differences in trajectories then continue over time (Skinner et al., 1998). The change-to-change process holds that early experiences are not the sole determinants of trajectories—there is an ongoing role for key factors that impact trajectories as well. Our study captures both processes by examining the role of perceived teaching support in early and subsequent motivation and engagement.

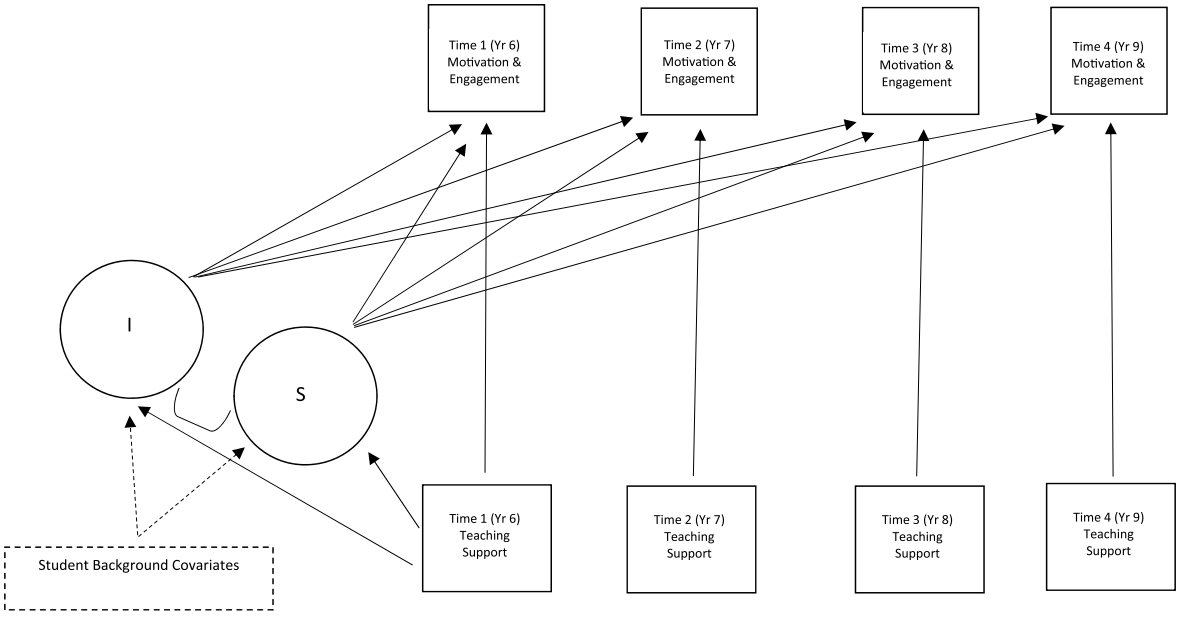

Fig. 1. *Hypothesized Model*
(Notes: I = intercept [i.e., initial levels] and S = slope [i.e., rate and/or nature of change over time].

3. Theory informing research into motivation and engagement trajectories

Numerous theories highlight the importance of motivation and engagement as the bases of optimal individual functioning, including social-cognitive theory (SCT; Bandura, 2001), situated expectancy-value theory (SEVT; Eccles & Wigfield, 2020), stage-environment fit theory (S-EFT; Eccles, Lord, & Midgley, 1991; Eccles, Lord, & Midgley, 1991), and positive youth development models (PYD; Lerner, Dowling, & Anderson, 2003). In their distinct ways, each of these various theories identify contextual factors that support adolescents' development by way of personal agency (e.g., motivation) and behavioral outcomes (e.g., engagement). For instance, SCT's triadic model identifies the role of contextual, personal agency, and behavioral factors that shape human functioning over time (Bandura, 2001); SEVT (and the cognate S-EFT) describes how socializers' practices (contextual) link to agency beliefs and behavioral outcomes (Eccles & Wigfield, 2020); and, PYD emphasizes the role of context in the development of young people's motivation and adaptive behavior (Lerner et al., 2003). Following these various perspectives, we investigated the role of teaching support (context) in shaping the development of adolescents' motivation (personal agency) and engagement (behavior).

In one way or another, these perspectives also describe how associations among these factors interplay at points in time and across time, including with respect to adolescents' motivation and engagement trajectories. We are especially interested in the extent to which students experience positive, negative, or non-linear motivation and engagement trajectories over this period (temporal effects), and if so, the extent to which perceived teaching support contributes to how these patterns may unfold in terms of initiating, slope, contemporaneous, sustaining, and escalating effects (Burns, Bostwick, et al., 2019). Identifying the role of perceived teaching support in how motivation and engagement trajectories play out across adolescence provides insight into modifiable factors that can be targeted for successful motivation and engagement patterns across an important stage of human development.

4. The study's key components

To represent teaching support as a dimension of context, we drew on the Classroom Assessment Scoring System (CLASS) approach (Hamre et al., 2013; Pianta & Hamre, 2009). We operationalized motivation by way of students' expectancy and valuing (Eccles & Wigfield, 2020). We operationalized engagement by way of academic and social behavioral engagement (perseverance, homework application, making schoolfriends, classroom [mis]conduct) (Burns et al., 2018). Fig. 1 shows the respective roles for each of these dimensions and in the discussion below we explain our rationale for investigating these factors.

4.1. Teaching support

In numerous theories describing human functioning, an individual's context is a significant element shaping development (Bandura, 2001; Eccles & Wigfield, 2020; Lerner et al., 2003). In the academic context, teaching support is a major contextual influence on students' educational development (Bardach & Klassen, 2021; Granziera et al., 2022). As noted earlier, teaching support refers to the assistance, instruction, and resources provided by teachers (Wong et al., 2018). We drew on the CLASS approach (Hamre et al., 2013; Pianta & Hamre, 2009) to operationalize teaching support by way of students' perceptions of a construct comprising emotional (teacher advocacy), instructional (expectations, organization and clarity, feedback-feedforward, instructional relevance), and management (classroom management) support indicators—all of which have been posited to represent quality pedagogy and impacting students' outcomes (Hamre et al., 2013; Pianta & Hamre, 2009). For instance, emotional support (specifically, teacher advocacy) is related to students' motivation and engagement (Granziera et al., 2022; Skinner & Belmont, 1993). Instructional support (specifically, expectations, organization and clarity, feedback-feedforward, and relevance) and management support (classroom management) are linked to enhanced motivation and learning (e.g., Gentrup, Lorenz, Kristen, & Kogan, 2020; Hattie & Timperley, 2007; Martin & Evans, 2018; Wang, Rubie-Davies, & Meissel, 2018). Management support, such as classroom management, is associated with enhanced motivation, learning, and achievement (Marzano & Marzano, 2003; Ning et al., 2015; Ponitz et al., 2009). We suggest these factors jointly reflect an underlying perceived teaching support dimension that enables a cohesive insight into how it links to specific motivation and engagement factors over time. No research has yet investigated the role of perceived teaching support in motivation and engagement trajectories through the lens of initiating through to escalating effects. This is important for ascertaining the most appropriate points of intervention. The present investigation addresses this gap by examining the role of perceived teaching support in patterns of motivation and engagement from early to mid-adolescence (see Fig. 1).

Indeed, outside the CLASS approach other researchers have identified similar teaching factors to those investigated here. For instance, in early work Skinner and Belmont (1993) identified structure (e.g., clear communication, predictability; similar to classroom management in our study) and involvement (e.g., warmth, belonging; similar to advocacy) as key components of teaching support (see also Bostwick et al., 2023; Klem & Connell, 2004; Pitzer & Skinner, 2017). In more recent work, Collie et al. (2017) outlined different types of support for students, including perceived academic support from teachers, as did Van Ryzin, Gravely, and Roseth (2009). As relevant to our study, much of this research into teaching support has emanated from understanding the role of such support in student motivation and engagement (e.g., Skinner & Belmont, 1993). This work has shown that when students hold positive perceptions of teaching support, they tend to also demonstrate positive academic motivation and engagement (e.g., Burns et al., 2018; Pitzer & Skinner, 2017; Van Ryzin et al., 2009). The present study expands this understanding of perceived teaching support to consider motivation and engagement trajectories.

4.2. Motivation and engagement

SEVT (Eccles & Wigfield, 2020) and the earlier expectancy-value theory (Wigfield & Eccles, 2000) are motivational frameworks often adopted to investigate students' academic development across time (Wigfield, Tonks, & Klauda, 2016). SEVT describes how a student's capacity to carry out a task is a function of their perceived competence (e.g., expectancy, self-efficacy) and the value they place on the task (Wigfield et al., 2016). Notably, a driving force of the present investigation is that expectancy and valuing tend to decline from early to mid-adolescence (Eccles et al., 1991; Fredricks & Eccles, 2002). *Expectancy* refers to students' belief in their capacity to effectively accomplish a task or activity (Eccles & Wigfield, 2020; Wigfield & Eccles, 2000; see also Bandura, 2001). Students with positive expectations tend to generate alternative approaches if they do not initially succeed, are energized and enthused when applying themselves to academic tasks, persist when things are difficult, and by implication are less inclined to give up (Bandura, 2001; Martin, Balzer, et al., 2022). With respect to *valuing*, students who believe that what they learn is interesting, useful, and important tend to be engaged in their learning and achieve highly (Martin, Balzer, et al., 2022; Martin & Steinbeck, 2017; Wigfield & Eccles, 2000). The present study explores adolescent trajectories of expectancy and valuing and the role of perceived teaching support in shaping these trajectories.

In line with our guiding theories that variously attend to behavioral outcomes, we focused on students' classroom- and school-based academic and social behavioral actions and involvement (Burns et al., 2022; 2018,; Fredricks, Blumenfeld, & Paris, 2004). Following prior research investigating academic and social behavioral engagement (e.g.,

Bostwick et al., 2022; Collie et al., 2023; Martin, Burns, et al., 2022; Martin et al., 2024), we included perseverance and homework application for academic behavioral engagement, and making schoolfriends and classroom (mis) conduct for social behavioral engagement. *Perseverance* refers to students' persistence in their schoolwork (Richardson, Abraham, & Bond, 2012) and is an important part of their positive responses to extended, large, or multi-part tasks (Burns et al., 2022; Bostwick et al., 2022; Collie et al., 2023). *Homework application* involves critical academic self-regulation skills (e.g., time management, strategy development, etc.; Ramdass & Zimmerman, 2011) relevant to learning (Fan, Xu, Cai, He, & Fan, 2017). *Making schoolfriends* is a form of social engagement connoting how much students relate to and connect with peers at school (Bostwick et al., 2022; Collie et al., 2023; Ryan & Deci, 2017). Friendships provide emotional support through school and assist academic and social-emotional development (Martin & Dowson, 2009). *Classroom (mis)conduct* (or, conduct problems) is a pattern of behavior in the classroom transgressing age/context-appropriate norms (Collie et al., 2023).

We attend to these particular motivation and engagement constructs for several reasons. First, with regard to motivation, our guiding theory (viz. SEVT, S-EFT; e.g., Eccles & Wigfield, 2020; Eccles et al., 2003) firmly places expectancy and valuing as focal constructs. Second, with regard to engagement, Martin, Martin, and Evans (2017) observed that major definitions of student engagement have framed it as the "outward manifestation of motivation" (Skinner & Pitzer, 2012, p. 22), "behaviors aligned with the energy and drive" to learn (Liem & Martin, 2012, p. 3), "publicly observable behaviors" (Reeve, 2012, p. 151), and the "behavioral manifestation of personal and social identities" (Eccles & Wigfield, 2002, p. 135). In each of these propositions, a behavioral perspective on engagement is salient. Therefore, while we recognize that engagement also comprises cognitive and affective components (e.g., Fredricks et al., 2004), in this study we operationalize it via behavioral means. Third, with respect to our specific engagement constructs, our selection was informed by theories that give attention to academic and social behavioral actions and involvement that take place in class or at school (e.g., Bandura, 2001; Eccles et al., 1991; Lerner et al., 2003). The academic engagement factors are quite well-established in theory and research (e.g., see Martin, 2012, 2022 for reviews), but it is appropriate to briefly frame social engagement for the purposes of this investigation. We again draw on one of our guiding theories (SEVT; Eccles & Wigfield, 2020) that articulates the situated aspects of students' motivation and engagement. Researchers attending to situated dimensions seek to explain how students' engagement is not only academically situated but also socially situated. There is reciprocity between the student's context and their behaviors that drive their actions and reactions in the classroom, including how they interact with and (mis)behave with others (see also Bergdahl & Hietajärvi, 2022; Hickey & Granade, 2004). In relation to our proposed academic and social behavioral dimensions, a recent study (Martin et al., 2024) showed that teaching support in Year 6 positively predicted Year 7 perseverance and homework application (academic behavioral engagement) and also making schoolfriends, and inversely, classroom (mis)conduct (social behavioral engagement)—but the study did not examine the developmental aspect of these links by way of engagement trajectories across adolescence—trajectories that have been theorized (Eccles et al., 2003) and now receive close consideration in the present study.

5. Research aims and envisaged yields

Our research aims were centered around the role of perceived teaching support in predicting the motivation and engagement trajectories of students from early (Year 6, Time 1) to mid-adolescence (Year 9, Time 4). Fig. 1 demonstrates the model we investigated. We were first interested in the extent to which students' motivation and engagement varied across Time 1 to Time 4 (i.e., a temporal effect; Aim 1). To the extent there is variation in students' trajectories across this time, we were then interested in the extent to which perceived teaching support in each of these years predicted these motivation and engagement trajectories in terms of five additional effects: initiating, slope, contemporaneous, sustaining, and escalating effects (Aim 2). Specifically, we explored: (a) initiating effects, such that perceived teaching support would predict lower or higher starting (Time 1) values of motivation and engagement; (b) slope effects, such that initial perceived teaching support would be associated with a rise or fall in motivation and engagement over time; (c) contemporaneous effects, such that for at least one timepoint, perceived teaching support would be associated with lower or higher values of motivation and engagement at that same time point; (d) sustaining effects, such that perceived teaching support would significantly predict motivation and engagement at all four timepoints; and (e) escalating effects, such that the predictive role of perceived teaching support on motivation and engagement would increase over time.

By addressing these aims, we seek to shed unique light on three of the Special Issue's guiding questions. First, in demarcating motivation and engagement trajectories into six distinct effects, the findings aim to progress current understanding about adolescents' academic development and how major theorizing can be applied to inform this understanding (Special Issue Question #2). Second, through LGM, we show how theory and longitudinal data can be integrated to build more appropriate developmental models in the psycho-educational space (Special Issue Question #4). Third, we demonstrate how longitudinal data on teachers' instruction can be a foundation for informing educators how to boost and sustain adolescents' motivation and engagement trajectories (Special Issue Question #5).

Insights gleaned will contribute to future applications of our guiding theories and frameworks (SCT, SEVT, S-EFT, launch and change-to-change processes) by suggesting new ways of operationalizing them across adolescence with respect to teaching support, motivation, and engagement. The study will also show how applying complex multivariate longitudinal models can generate distinct information about when and how teaching support links to students' motivation and engagement trajectories. Additionally, it will elucidate the specific motivation and engagement factors that are most closely linked to this teaching support. Moreover, because the study traverses primary and high school, tracking students across critical developmental windows and different educational settings, its findings will have wide applicability and practical reach.

6. Methods

6.1. Participants and procedure

The study comprised $N = 7769$ Year 6 students (Time 1; the final year of primary [elementary] school) who were tracked annually into Year 9 (Time 4; middle of high school). At Time 1, students were from 774 government primary schools and at Times 2–4 students were from 247 government high schools across the state of New South Wales (NSW, Australia's most populous state). In order to conduct LGM on a complete set of 4-wave data, the final sample comprised students who completed the full set of measures at each of the four waves of data collection, whose destination high schools participated in the survey, whose schools opted to do the full survey that included the measures central to this study, and who remained in the same high school between Year 7 (2019) and Year 9 (2021). Half the sample was female (50%). Student socio-economic status (SES) was assessed using a composite measure conceptually similar to the Index of Economic, Social and Cultural status (ESCS) used in the Programme for International Student Assessment (PISA). The index is based on students' responses to survey questions on their family structure, highest level of parental education, and availability of educational resources at home, such as books or a computer (statewide $M = 0$, $SD = 1$; scores <0 reflect below mean state-wide SES). The mean sample SES score was $M = 0.17$ ($SD = 0.96$). A total of 14% of

students identified as overseas born. At the outset of the study, most (81%) students were in major urban centers of NSW, with the remainder in regional and remote areas of NSW. All Year 6 students attended co-educational primary schools. Once in high school, 84% attended co-educational high schools (7% and 9% of students were at single-sex boys' and single-sex girls' high schools respectively).

The data were part of the NSW Department of Education's annual "Tell Them from Me"[1] (TTFM) student survey (conducted since 2013), developed in Canada (Willms, 2014), and adapted to the Australian context. The survey collects responses from students about their perceptions of teaching support, motivation, and engagement. The TTFM survey has been administered in several countries, including Australia and the United States, with numerous studies demonstrating the validity of the survey measures (Collie et al., 2023; Bostwick et al., 2022; Martin, Burns, et al., 2022; Martin et al., 2024; The Learning Bar, 2019). The TTFM survey was offered to schools by the NSW Centre for Education Statistics and Evaluation (CESE; located within the NSW Department of Education) and administered by the survey company, The Learning Bar. It was made available free of charge to all NSW government schools with the objective to provide schools with data-driven information for student and school improvement. The academic year in Australia begins in late January/early February (Term 1). For this study's cohort of students, Term 1 of 2018 was the start of Year 6 (Time 1) and Term 1 of 2021 was the start of Year 9 (Time 4). The survey was conducted on an opt-out consent basis. Schools ensured that parents/carers had an opportunity to decline using opt-out consent forms and communication templates (provided by CESE to every school in 22 community languages). The study received ethical approval from the first author's institutional review board (#HC190893).

6.2. Materials

The measures in this study comprised perceived teaching support, motivation, and engagement. These were captured annually from 2018 (Time 1, Year 6) to 2021 (Time 4, Year 9). Also included were key covariates (student background attributes—but not school attributes as analyses were at the student-level, not school-level). Descriptive statistics and reliability scores (≥0.70 interpreted as acceptable; e.g., McNeish, 2018) for each substantive factor are displayed in Table 1. In Table S1 of Supplementary Materials are the target bivariate latent correlations among the substantive factors.

6.2.1. Teaching support

In line with Hamre et al. (2013) and Pianta and Hamre (2009), teaching support was assessed in each of 2018–2021 (Time 1 to Time 4) via five constructs to reflect the major domains of teaching based on students' perceptions of: advocacy (for emotional support), expectations, organization and clarity, and instructional relevance (for instructional support), and classroom management (for management support). Given the very large number of variables and parameters in a 4-wave LGM, a global latent teaching support factor (with the five teaching supports as indicators) was modeled. This was considered defensible given an initial CFA of the teaching support factors (for 2018 as a case in point as it is common to both time-invariant and time-varying analyses) showed that a higher-order global-factor (CFI = 0.94, RMSEA = 0.05) fit just as well as a first-order five-factor model (CFI = 0.94, RMSEA = 0.05) and three-factor model (the three CLASS dimensions; CFI = 0.94, RMSEA = 0.05). Indeed, many other researchers have used more global measures of students' perceptions of teaching support (e.g., Collie et al., 2023; Martin, Burns et al., 2021; Martin et al., 2024; Martin & Marsh, 2008; Yun et al., 2018). However, for completeness in Tables S2–S6 of Supplementary Materials, we present findings of separate LGMs for each of the five teaching support factors.

As Table 1 shows, reliability was sound for teaching support at each of the four time points. Advocacy was assessed with four items about the extent to which students' teachers supported and cared for their learning and academic wellbeing (e.g., "My teacher is interested in my school assignments"). Expectations was measured with four items (e.g., "My teacher expects all students to do their best work") connoting teachers' expectations for students to complete their work, try hard, and strive to do their best. Organization and clarity were together captured via five items (e.g., "My teacher can explain difficult ideas"; labelled 'Effective Learning Time' in TTFM) reflecting teachers' management of lesson time to optimize learning and organization and clarity of content and tasks. Relevance was measured with three items about the meaningfulness, usefulness, and purposefulness of the teaching and content (e.g., "The things we learn at school are useful in my everyday life"). Classroom management was measured by way of four items about the rules and routines within the class (e.g., "Teachers do not let us misbehave in class"; labelled 'Learning Climate' in TTFM). All items were assessed on a five-point scale of 0 (strongly disagree) to 4 (strongly agree).

Each student was asked to rate one teacher. For primary school students it was their regular classroom teacher. To reduce respondent burden, high school students were randomly assigned to one subject domain (i.e., science, mathematics, or English) in which to rate teaching support (i.e., one student was randomly assigned to rate their science teacher, another randomly assigned to rate their mathematics teacher, and another randomly assigned to rate their English teacher). Importantly, items were worded the same across the three domains (i.e., parallel items). Regardless of their subject domain, students' responses to each item were indicators of the target factor in modeling (e.g., classroom management item #1, classroom management item #2, etc. as indicators of classroom management). For example, if Student A was assigned the science teaching support items, Student B was assigned the mathematics teaching support items, and Student C was assigned the English teaching support items, then Student A's classroom management item #1 in science, B's parallel classroom management item #1 in mathematics, and C's parallel classroom management item #1 in English would all be used as the item 1 indicator for classroom management. This is consistent with a prior study of high school teaching support and students' growth goals where test administrators sought to reduce respondent burden yet attain adequate coverage across subjects (Martin, Burns, et al., 2022). This approach was also considered feasible given research showing the positive alignments between students' domain-general and domain-specific perceptions (Bong, 2001; Green, Martin, & Marsh, 2007) and the potential trait-like motivations that span school subjects even in the context of domain-specificity (e.g., Trautwein, Lüdtke, Schnyder, & Niggli, 2006).

6.2.2. Motivation and engagement

Motivation comprised expectancy and valuing. Engagement focused on students' academic and social behavioral engagement (perseverance, homework application, making schoolfriends, misconduct). As Table 1 shows, reliability was sound for each measure at each of the four time points.

Expectancy sought to capture students' positive future academic expectancies and was assessed with a single item ("After high school, I plan to go to university"; labelled as 'Aspirations' in TTFM) and rated on a scale of 0 (strongly disagree) to 4 (strongly agree). *Valuing* was assessed via two items focused on students' beliefs about the importance of school (e.g., "It is important for me to learn what is taught at school"). A five-point scale of 0 (strongly disagree) to 4 (strongly agree) was used to respond to items. *Perseverance* reflected students' persistence towards completion of schoolwork and planned action and was measured with four items (e.g., "I finish whatever I begin") and rated on a five-point scale (from 0 = almost never to 4 = almost always or from 0 =

[1] "Tell Them From Me" is a registered trademark belonging to The Learning Bar and further details on the TTFM survey can be found at https://education.nsw.gov.au/student-wellbeing/tell-them-from-me.

Table 1
Reliability estimates and descriptive statistics.

	Time 1 (Yr 6)			Time 2 (Yr 7)			Time 3 (Yr 8)			Time 4 (Yr 9)		
	Reliability	Mean	*SD*	Reliability	Mean	*SD*	Reliability	Mean	*SD*	Reliability	Mean	*SD*
Outcomes												
Expectancy	–	3.06	1.13	–	3.03	1.17	–	2.92	1.20	–	2.83	1.24
Valuing	0.73	3.35	0.80	0.78	3.11	0.89	0.79	2.80	0.92	0.78	2.54	0.96
Perseverance	0.82	2.85	0.86	0.88	2.70	0.98	0.90	2.43	1.02	0.90	2.27	1.05
Homework Application	0.74	1.91	0.77	0.75	1.81	0.75	0.77	1.52	0.77	0.76	1.37	0.77
Making Schoolfriends	–	2.98	1.11	–	2.86	1.08	–	2.69	1.10	–	2.56	1.10
Misconduct	0.80	0.25	0.54	0.77	0.15	0.41	0.81	0.25	0.53	0.82	0.28	0.57
Predictor												
Teaching Support	0.86	3.12	0.62	0.85	2.81	0.66	0.85	2.60	0.69	0.84	2.40	0.72

Notes.
SD = standard deviation.
Expectancy and Making Schoolfriends are single items and so reliability cannot be estimated; For Valuing, Cronbach's alpha is used for reliability (as it is 2 items) and for all other scales, Omega is used.

strongly disagree to 4 = strongly agree; depending on the item wording). *Homework application* sought to capture students' attendance to, engagement with, and completion of homework and was measured with three items (e.g., "When I have homework, I hand it in on time"). Year 6 students responded to these items on a five-point scale of 0 (strongly disagree) to 4 (strongly agree) and Years 7–9 students responded on a four-point scale of 0 (strongly disagree) to 3 (strongly agree)—and thus for scale consistency across time, we transformed all to a four-point (0–3) scale. *Making schoolfriends* focused on students' capacity to socially connect with peers at school and was assessed with one item ("I am able to make friends easily"; from the broader 'Sense of Belonging' scale in TTFM). The item was assessed on a five-point scale of 0 (strongly disagree) to 4 (strongly agree). *Misconduct* (or, disruptive behavior; Collie et al., 2023) focused on students' off-task or disruptive behavior in the classroom and comprised three items ("[In the past 4 weeks, I have been spoken to by a teacher or principal for] Breaking a school rule"). Students responded using a 0 (never) to 3 (almost every day) continuum.

6.2.3. Student background attributes (covariates)

We also accounted for relevant background factors as covariates to include as predictors through the model (and thus purge the model of variance attributable to them in order to gain a sense of unique variance associated with perceived teaching support; see Fig. 1). Student background covariates comprised *gender* (0 = male; 1 = female), *overseas born* (0 = No; 1 = Yes), *SES* (a continuous measure of an index of students' social and economic resources, described in Participants), and *prior achievement* (assessed via a standardized measure of students' performance in the reading and numeracy components of National Assessment Program—Literacy and Numeracy (NAPLAN; National Assessment Program [NAP], 2016).

6.3. Data analysis

The main analyses (LGM) were conducted in M*plus* v8.80 (Muthén & Muthén, 1998-2022). Models employed the robust maximum likelihood (MLR) estimator, which is robust to non-normality (Muthén & Muthén, 2022). Missing data (5%) were handled using the full information maximum likelihood (FIML; Enders, 2010) defaults in M*plus*. FIML reduces bias and resolves major criticisms of listwise and mean substitution approaches (e.g., Schafer & Graham, 2002). The root mean square error of approximation (RMSEA) and comparative fit index (CFI) were used to assess model fit. Adequate fit was indicated by RMSEA $\leq$0.08 and CFI $\geq$0.90. Excellent model fit was indicated by RMSEA $\leq$0.05 and CFI $\geq$0.95 (Hu & Bentler, 1999).

Following preliminary tests and demonstration of invariance (described in Supplementary Materials), LGM was conducted, which is a time-structured multilevel model where scores on repeated measures are nested within-person, as well as between-person. As relevant to this investigation, LGM thus ascertains within-person changes (e.g., shape of change) and between-person differences in motivation and engagement (e.g., differences in trajectory factors; Kline, 2016). For completeness, we also conducted preliminary tests to decide if LGMs needed to account for nesting of students within schools. We ran conditional models where solutions were adjusted for student nesting within their primary school (Time 1) and then their high school (Times 2–4). In these analyses, the same intercept and slope parameters were significant as the intercept and slope parameters in the conditional models where nesting was not conducted. We therefore retained the simpler approach and did not adjust for nesting of students within schools.

There were two main parts to our LGM. In both parts, latent growth curve (curve-of-factors; doubly latent) modeling was used for multi-item motivation and engagement factors (valuing, perseverance, homework application, misconduct) (Wickrama, Lee, O'Neal, & Lorenz, 2016), but not for single-item motivation and engagement factors (expectancy, making schoolfriends). For the multi-item motivation and engagement factors, effects-coding was used in both unconditional and conditional models. This is considered appropriate given that the estimates reflect the metric of the indicators and allow meaningful cross-construct comparisons when the same response scale is used across time (Little, Slegers, & Card, 2006). For single-item factors, mean scores were used.

The first model was an unconditional (baseline) model that explored for main effects of change in motivation and engagement over time—that is, *temporal effects*. This model addresses if and to what extent students' motivation and engagement change over time (Wickrama et al., 2016). Intercept and slope estimates and variances are of interest, and if significant, indicate noteworthy within-student change. The sign of the slope is also of interest as it indicates if the change over time is negative or positive (Kline, 2016). Significant intercept and slope variances signal noteworthy between-student differences (Kline, 2016). Taken together, significant intercept and slope estimates and variance allow a conclusion that motivation and engagement are significantly changing over time and between students (Wickrama et al., 2016).

The second was a conditional model that included all teaching support and covariates as predictors of each motivation and engagement factor in order to simultaneously examine the *initiating, slope, contemporaneous, sustaining,* and *escalating effects* (Burns, Bostwick, et al., 2019). Initial teaching support (Time 1 teaching support) and the covariates (gender, overseas born, SES, prior achievement) were modeled to ascertain *initiating* and *slope effects* because they constitute time-invariant factors (viz., do not change over time [in the case of covariates] or reflect the initial values of substantive measures [in the case of T1 teaching support]; Kline, 2016). Time-invariant factors are hypothesized to account for between-student differences in that they explain variance around the mean estimates of the intercept and slope (Wickrama et al., 2016). Teaching support at all four time points were modeled to determine the *contemporaneous, sustaining,* and *escalating*

effects because they constitute time-varying factors (viz., potential to change over time). Because each time-varying teaching support factor was modeled to link to motivation and engagement at the same time point (e.g., T2 teaching support→T2 valuing), time-varying teaching support was hypothesized to account for further within-student variance that is not explained by the underlying trajectory. Follow-up comparisons (applying Eid, Gollwitzer, & Schmitt, 2010; Peterson & Brown, 2005 approaches) were also conducted to further assess escalating effects (i.e., if each of the contemporaneous effects were significantly different from one another). Additional details for the unconditional and conditional LGM analyses are provided in Supplementary Materials.

7. Results

7.1. Unconditional growth model analysis

For each motivation and engagement factor, linear and quadratic slopes were tested. The unconditional LGMs for motivation and engagement factors demonstrated good fit as shown in Table S7 of Supplementary Materials (all RMSEAs <0.07 and all CFIs ≥0.95). Thus, the specified (linear or quadratic) growth models were appropriate models of change for motivation and engagement. Table 2 (see Means Linear Slope) shows significant linear slopes for four factors: valuing, perseverance, homework application, and misconduct. Table 2 (see Means Quadratic Slope) shows significant quadratic slopes for two factors: expectancy and making schoolfriends. These findings for slopes were evidence of *temporal effects*. Accordingly, in subsequent analyses for valuing, perseverance, homework application, and misconduct, we employed conditional and unconditional models with linear slopes; for expectancy and making schoolfriends, we employed conditional and unconditional models with linear and quadratic slopes. Table 2 (see Means Intercept and Variances Intercept) shows that initial means and variances of motivation and engagement were significant (thus, initial values of motivation and engagement were significantly different from zero and there was significant between-person variance in these values). Table 2 (see Variances Linear Slope and Quadratic Slope) also shows that variances of motivation and engagement slopes were significant, demonstrating that motivation and engagement slopes were significantly changing over time and that there was significant between-person variance in these changes. In Fig. S1 of Supplementary Materials are raw score (mean) plots for motivation and engagement over time. Taking slope estimates and figure plots into account, expectancy (especially Time 2/Year 7 onwards), valuing, perseverance, homework application, and making schoolfriends declined, while misconduct increased over the 4-year period. The unconditional model findings provided empirical justification for proceeding to conditional models.

7.2. Conditional latent growth model

The conditional LGMs, which included perceived teaching support as

Table 2
Estimates from the unconditional and conditional models.

	Expectancy		Valuing		Perseverance		Homework Application		Making Schoolfriends		Misconduct	
	Uncond	Cond	Uncond	Cond	Uncond	Cond	Uncond	Cond	Uncond	Cond	Uncond	Cond
Means[a]												
Intercept	3.04***	3.04***	3.35***	3.35***	2.86***	2.85***	1.93***	1.92***	2.98***	2.98***	0.17***	0.17***
Linear Slope	−0.02	−0.02	−0.27***	−0.27***	−0.20***	−0.20***	−0.16***	−0.15***	−0.14***	−0.14***	0.03***	0.03***
Quadratic Slope	−0.02***	−0.02***	–	–	–	–	−0.01*	−0.02***	–	–	–	–
Variances[a]												
Intercept	0.83***	0.61***	0.26***	0.09***	0.43***	0.23***	0.28***	0.13***	0.57***	0.44***	0.08***	0.05***
Linear Slope	0.41***	0.37***	0.04***	0.02***	0.06***	0.04***	0.10***	0.05*	0.05***	0.04***	0.01**	0.01**
Quadratic Slope	0.03***	0.03***	–	–	–	–	0.01**	~0.00	–	–	–	–
Correlations												
Intercept, Linear Slope	−0.30***	−0.40***	−0.29***	−0.43***	−0.27***	−0.27***	−0.13	−0.43***	−0.40***	−0.43***	0.09	0.06
Intercept, Quadratic Slope	0.17*	0.24**	–	–	–	–	−0.13	0.24	–	–	–	–
Linear Slope, Quadratic Slope	−0.90***	−0.91***	–	–	–	–	−0.83***	−0.85***	–	–	–	–
Time-invariant predictor of I												
Time 1 Teaching Support		−0.04		0.23***		0.14***		0.08		0.18***		−0.01
Time-invariant predictor of Linear S												
Time 1 Teaching Support		0.14		−0.08		−0.05		0.06		−0.10*		−0.08
Time-invariant predictor of Quadratic S												
Time 1 Teaching Support		−0.14		–		–		−0.11		–		–
Time-varying predictors of Outcomes												
T1 Teach→T1 Outcome		0.25***		0.60***		0.37***		0.52***		0.22***		−0.25***
T2 Teach→T2 Outcome		0.26***		0.56***		0.55***		0.63***		0.29***		−0.23***
T3 Teach→T3 Outcome		0.27***		0.67***		0.57***		0.63***		0.35***		−0.33***
T4 Teach→T4 Outcome		0.35***		0.70***		0.57***		0.63***		0.40***		−0.35***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$; a = unstandardized values provided in keeping with original metric; ~0.00 = parameter estimate lies between −0.01 and 0.01.
Notes.
Effects for background attribute covariates (gender, overseas born, SES, prior achievement) are shown in Supplementary Materials Table S8.
Fully unstandardized solution is in Supplementary Materials Table S9.
I = intercept; S = slope; Uncond = Unconditional model; Cond = Conditional model.
Linear and quadratic slopes were tested in unconditional models; the quadratic model was estimated in conditional analyses if means and variances of quadratic slopes were significant in unconditional models (as was the case for Expectancy and Homework Application) – otherwise linear models were estimated in the conditional models.

predictors of Time 1 to Time 4 motivation and engagement (as well as covariates as per Fig. 1), demonstrated good fit to the data as shown in Table S7 of Supplementary Materials (all RMSEAs <0.05 and all CFIs ≥0.92). This suggests that the specified (linear or quadratic) growth models, with the inclusion of the explanatory factors, were appropriate for these data. Table 2 presents all standardized beta paths that are necessary to appraise initiating, slope, contemporaneous, sustaining, and escalating effects (in Table S8 of Supplementary Materials are findings for all covariates and in Table S9 is the solution for unstandardized parameters).

Initiating effects (see Table 2, Time-invariant Predictors of I). Perceived teaching support demonstrated significant initiating effects, such that it positively predicted the intercept of valuing, perseverance, and making schoolfriends at Time 1. Thus, perceived teaching support was positively associated with initial levels of valuing, perseverance, and making schoolfriends, but was unassociated with the remaining factors.

Slope effects (see Table 2, Time-invariant Predictors of S). In the main, initial perceived teaching support did not yield significant slope effects—with the exception of a link to a negative slope for making schoolfriends. Here, it appears higher initial perceived teaching support was associated with steeper declines in making schoolfriends over time (this is further explored in the Discussion, below).

Contemporaneous effects (see Table 2, Time-varying Predictors of Outcomes). The criterion for a contemporaneous effect is that for at least one timepoint, perceived teaching support would be associated with motivation and engagement at that same timepoint (sustaining effects, below, take into account which particular timepoints for which particular outcomes). Results demonstrated that perceived teaching support did have significant contemporaneous effects for all motivation and engagement factors, such that for at least one timepoint, perceived teaching support was positively associated with expectancy, valuing, perseverance, homework application, and making schoolfriends—and negatively associated with misconduct.

Sustaining effects (see Table 2, Time-varying Predictors of Outcomes). There was also support for significant sustaining effects such that for each of Times 1 to 4 (2018–2021), perceived teaching support was positively associated with expectancy, valuing, perseverance, homework application, and making schoolfriends—and negatively associated with misconduct. Relatively larger perceived teaching support effects were found for valuing, perseverance, and homework application.

Escalating effects (see Table 2, Time-varying Predictors of Outcomes). Perceived teaching support also demonstrated escalating effects for motivation and engagement. As Table 2 shows, from Time 1 to Time 4 there was an incline in the regression weights between perceived teaching support and each motivation and engagement factor. Follow-up comparison tests confirmed a significant difference between the Time 1 (2018) and Time 4 (2021) regression weights for expectancy ($z = -9.69$, $p < 0.001$), valuing ($z = -15.35$, $p < 0.001$), perseverance ($z = -22.83$, $p < 0.001$), homework application ($z = -14.55$, $p < 0.001$), making schoolfriends ($z = -17.63$, $p < 0.001$), and misconduct ($z = 9.69$, $p < 0.001$). These results suggest that perceived teaching support played an increasingly important role as students progressed through school.

8. Discussion

Our study focused on the role of perceived teaching support in students' motivation and engagement trajectories in each of four years spanning early to mid-adolescence (Time 1, Year 6 in 2018 to Time 4, Year 9 in 2021). We found evidence for temporal, initiating, contemporaneous, sustaining, and escalating perceived teaching support effects. Each of these—and the implications for theory and practice—are now discussed.

8.1. Findings of note

Our findings identified a *temporal effect* that confirmed the well-documented decline in motivation and engagement during adolescence (Burns, Bostwick, et al., 2019; Burns, Martin, & Collie, 2019)—and also shows that motivation and engagement can change and to this extent may be amenable to educational intervention. As relevant to our study, teaching support is one possible intervention and, indeed, we found it did play a significant role. To more closely understand the precise nature of this role during adolescence, we considered teaching support in terms of five predictive effects (from "initiating" to "escalating" effects). As these five effects were the major and novel aspect of the study, they are now the focus of the discussion, beginning with consideration of initiating effects.

The significant *initiating effects* found in this study demonstrated that students reporting higher levels of teaching support in early adolescence (Year 6, Time 1) had more positive motivation and engagement at this time (relative to students reporting lower levels of teaching support). Perceived teaching support was thus associated with higher initial motivation and engagement. This suggests that any developmental declines during Year 7 to Year 9 would be coming off a higher base in Year 6 and would help students avoid motivation and engagement lows that may otherwise have been the case. For example, when considering two students with differing levels of initial motivation and engagement, the student with initially higher levels of motivation and engagement may not realize the same lows that the other student might. The present study suggests teaching support is one factor that may explain the former student's more positive motivation and engagement pattern.

Teaching support also yielded significant and positive *contemporaneous effects*, such that students who reported higher levels of teaching support at a given time point tended to have more positive motivation and engagement at that same time point (relative to students reporting lower levels of teaching support). Furthermore, our data confirmed significant and positive *sustaining effects* such that contemporaneous effects occurred in every year of our four-year study. Thus, perceived teaching support has an immediate positive link to students' motivation and engagement when a teacher implements such support (the contemporaneous effect) and perceived teaching support has an ongoing positive link to students' motivation and engagement through adolescence (the sustaining effect). In these two ways, teaching support can play a positive role in adolescents' motivation and engagement at any given point in time and across time. Perceived teaching support at each time point was correlated with teaching supports at other time points and so any variance shared from one year to another is controlled for—or, put another way, teaching support effects in one year were beyond variance in teaching support from a previous year.

We also found *escalating effects* such that the predictive strength of perceived teaching support increased at each point in time (i.e., a higher predictive effect at Time 2 than Time 1, at Time 3 than Time 2, and at Time 4 than Time 3). This suggests that while initial perceived teaching support did not impact the overall negative trajectory of motivation and engagement (i.e., no slope effect, discussed below), it did yield an increasing buffering effect against this decline over time. Given the important role motivation and engagement play in students' academic development (Martin, 2023; Pintrich, 2003), this finding (alongside the sustaining effect) suggests that teaching support is a viable means for continually promoting motivation and engagement through adolescence. As we noted in the Introduction, this is an empowering finding for educators because adolescence is typically seen as a time when the influence of adults declines (Lam et al., 2014). Our results show that in terms of motivation and engagement, it seems that students come increasingly into their teacher's orbit the further into adolescence they progress. In fact, this may have implications for other perspectives on adolescence. For example, adolescence has historically been stereotyped as a period of "stress and storm" increasingly removed from the influence of pro-social adults, but the present findings suggest that significant

adults do play a part in adolescents' development.

Notwithstanding support for initiating, contemporaneous, sustaining, and escalating effects, there was less support for slope effects. Previous research has discussed the prevalence of the motivation and engagement decline during adolescence (Burns, Bostwick, et al., 2019; Burns, Martin, & Collie, 2019), suggesting that this is a pan-adolescent experience (confirmed by this study's temporal effects). Thus, despite the presence of initiating, cotemporaneous, sustaining, and escalating effects of teaching support—that can be considered unique effects in that they controlled for shared variance among teaching support measures from year to year—the general lack of a slope effect indicates that the decline in motivation and engagement during adolescence (the temporal effect) is stubborn. The general absence of slope effects (a) suggests that reversing this decline in motivation engagement may require more targeted and intensive interventions and (b) reinforces the importance of ongoing teaching support as something of a mitigator against motivation and engagement lows that may otherwise ensue.

All that said, there are two slope-related effects that warrant further discussion. The first is the significant link between initial teaching support (intercept) and a decline in making schoolfriends. In line with prior research on young people's social-emotional outcomes (Collie et al., 2023), this decline may reflect the fact that teachers in Year 6 (the Time 1 intercept point) were mindful of students in their classroom who struggle socially-emotionally and provided higher support, but when students moved to a large high school (Years 7–9, Times 2 to 4) with many teachers, the need for this support may not have been apparent—hence a relationship between high initial teacher support and later declines in making friends. Further research is needed to (dis) confirm this contention.

The second slope-related effect to note relates to the significant negative correlation between the intercepts and slopes of motivation and engagement. This indicates that initially higher values of motivation and engagement are correlated with steeper declines in motivation and engagement (lower group means each year). In part this is not surprising because declines across adolescence are well known (Burns, Bostwick, et al., 2019; Burns, Martin, & Collie, 2019) and so students coming off a high base have further to decline during this challenging developmental period. Nevertheless, to better understand this finding we conducted some additional exploration of the data (with a focus on the motivation factors [expectancy and valuing] as cases in point) to compare the means at Time 2, Time 3, and Time 4 across low and high levels of initial (Time 1) motivation. Analyses revealed that despite the steeper declines in motivation for students with high initial motivation, these students still had significantly higher motivation than those with low initial motivation at each of Time 2, Time 3, and Time 4. We can therefore conclude that despite a negative intercept-slope correlation, high initial levels of motivation and engagement are still working in students' favor over time.

The final set of findings we draw out for particular attention pertain to the motivation and engagement factors that perceived teaching support was most consistently associated with: valuing and perseverance. These two outcomes were the only ones significantly linked to perceived teaching support by way of all initiating, contemporaneous, sustaining, and escalating effects—and for the latter three effects yielded the largest predictive parameters. With regard to valuing, we note that our teaching support construct comprised instructional support in the form of relevance, and this may have promoted students' sense that teaching content and learning tasks were especially meaningful, interesting, and useful for them—all dimensions of valuing (Hidi & Renninger, 2006; Wigfield & Eccles, 2000). For perseverance, we also note that teaching support comprised emotional support (by way of teacher advocacy) and instructional support (by way of feedback-feedforward) that are both known to be a basis for encouragement and persistence in the face of challenge (Granziera et al., 2022; Hattie & Timperley, 2007; Martin & Evans, 2018).

8.2. Implications for theory, research, and practice

In several ways the findings connect to major theories of human development and functioning, including adolescent academic development. In showing early and ongoing variation in motivation and engagement and the role of teaching support over time, our findings inform the launch and change-to-change processes theorized by Skinner et al. (1998; see also Collie & Martin, 2023; Rickert & Skinner, 2023). Specifically, perceived teaching support positively predicted motivation and engagement starting points (i.e., intercepts—thus, an early launching role; but not slopes) and then played an ongoing (change--to-change) role in the following three years. Stage-environment fit theory (Eccles et al., 1991Eccles et al., 1991; 2003) speaks to the decline in motivation and engagement across early to mid-adolescence and this decline was clearly demonstrated in our data. S-EFT also makes particular reference to school being a factor in this decline and our findings supported this in that perceived teaching support was associated with more positive motivation and engagement across four years of school. In similar vein, we drew on social-cognitive theory (SCT; Bandura, 2001), situational expectancy-value theory (SEVT; Eccles & Wigfield, 2020), and positive youth development (PYD; Lerner et al., 2003) to posit (and subsequently confirm) the important role of context (by way of teaching support) in young people's motivation and engagement developmental patterns.

The study's teaching support construct aligned with major indicators under the CLASS approach (Hamre et al., 2013; Pianta & Hamre, 2009; see also Collie et al., 2023; Martin et al., 2024) and our modeling of it shed unique light on its effects across time. For example, we were able to elucidate specific motivation and engagement factors that were most closely linked to teaching support and the longitudinal pattern of these effects that are not readily evident in more typical cross-sectional or two-time-point research designs. As a case in point, the fact we found increasing strength in paths between teaching support and motivation and engagement (escalating effects) is novel. As noted, this is quite a potent insight given adolescence is often framed as a time when students are distancing from adults' influence (Lam et al., 2014). There are also implications for practice. For example, emotional support was indicated by teacher advocacy and there is well-documented practical advice about how to enhance teacher-student relationships, including greater attention by teachers to getting to know students, accepting students' individuality, listening to students' perspectives, and providing emotional encouragement when needed (e.g., Granziera et al., 2022; Martin & Dowson, 2009). For instructional support we included an indicator for relevance. Teacher strategies for promoting relevance include identifying the importance of tasks and content and ensuring that teaching content and learning tasks are significant, interesting, personally meaningful, and useful (Hidi & Renninger, 2006; Wigfield & Eccles, 2000). For management support, the indicator of classroom management and practice efforts includes giving greater attention to clear, consistent, and logical behavioral expectations, whilst not stifling students' autonomy (Jang, Reeve, & Deci, 2010). Encouraging student input as classroom rules are developed and explaining why behavioral expectations are important can also support constructive management support (Skinner & Belmont, 1993).

8.3. Limitations, future research, and conclusion

There are some limitations to consider when interpreting results. There are also directions for future research emanating from the study. First, although we had an objective measure of prior achievement, the central motivation and engagement variables were self-reported. We suggest researchers include other perspectives in future measurement, such as parent and/or teacher reports of students' motivation and engagement (Jungert, Levine, & Koestner, 2020). We also remind the reader that teaching support data were garnered from students' reports (thus, perceived teaching support). Researchers might now collect other

(e.g., expert observer) perspectives on teaching support (indeed, the CLASS approach is ideal for this; Hamre et al., 2013; Pianta & Hamre, 2009). Second, our study comprised domain-general motivation and engagement measures. Research might now investigate teaching support in specific school subjects and its role in domain-specific motivation and engagement (Green et al., 2007). On a related note, although we earlier explained our selection of particular motivation and engagement constructs, we do suggest further research that investigates adolescent trajectories of other constructs—such as specific forms of cognitive and affective engagement. We leave open the possibility that a different set of teaching support, motivation, and engagement constructs may yield different findings. Third, the nature of our dataset was such that classrooms could not be identified, obviating classroom-level analyses. Future research into adolescent motivation and engagement trajectories should include classroom indicators to enable student- and classroom-level insights (Goldstein, 2003). Also, due to the complexity of modeling across primary and high schools, we did not cluster as a function of school or include school covariates—but these school factors would be possible to investigate in research where students stay in the same school. Finally, future research might augment our growth modeling design with intervention research that can further ascertain the precise role of perceived teaching support in adolescents' motivation and engagement development. Notwithstanding these limitations, our findings contribute to knowledge about how to support the motivation and engagement trajectories of students who may struggle during adolescence—and identify ways to also sustain the positive trajectories of those who are effectively navigating these important adolescent years.

Funding

This study was funded by the New South Wales Department of Education (UNSW#RG221745).

CRediT authorship contribution statement

Andrew J. Martin: Conceptualization, Formal analysis, Funding acquisition, Writing – original draft, Writing – review & editing. **Rebecca J. Collie:** Conceptualization, Writing – original draft, Writing – review & editing, Funding acquisition. **Mary Stephan:** Data curation, Methodology, Project administration, Writing – original draft, Writing – review & editing. **Anaïd Flesken:** Data curation, Methodology, Writing – original draft, Writing – review & editing. **Fiona Halcrow:** Data curation, Methodology, Writing – original draft, Writing – review & editing. **Brianna McCourt:** Data curation, Methodology, Writing – original draft, Writing – review & editing.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.learninstruc.2024.101910.

References

Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review of Psychology, 52*, 1–26. https://doi.org/10.1146/annurev.psych.52.1.1

Bardach, L., & Klassen, R. M. (2021). Teacher motivation and student outcomes. *Educational Psychologist, 56*(4), 283–297. https://doi.org/10.1080/00461520.2021.1991799

Benner, A. D., Boyle, A. E., & Bakhtiari, F. (2017). Understanding students' transition to high school. *Journal of Youth and Adolescence, 46*, 2129–2142. https://doi.org/10.1007/s10964-017-0716-2

Bergdahl, N., & Hietajärvi, L. (2022). Social engagement in distance-, remote-, and hybrid learning. *Journal of Online Learning Research, 8*(3), 315–342.

Bong, M. (2001). Between- and within-domain relations of academic motivation among middle and high school students: Self-efficacy, task value, and achievement goals. *Journal of Educational Psychology, 93*(1), 23–34. https://doi.org/10.1037/0022-0663.93.1.23

Bostwick, K., Martin, A. J., Collie, R. J., Burns, E. C., Hare, N., Cox, S., et al. (2022). Academic buoyancy in high school: A cross-lagged multilevel modeling approach exploring reciprocal effects with perceived school support, motivation, and engagement. *Journal of Educational Psychology, 114*(8), 1931–1949. https://doi.org/10.1037/edu0000753

Bostwick, K., Martin, A. J., Collie, R. J., & Durksen, T. (2022). Motivation in context: A multilevel examination of growth orientation across one year. *Journal of Applied Developmental Psychology, 81*, Article 101435. https://doi.org/10.1016/j.appdev.2022.101435

Burns, E. C., Bostwick, K., Collie, R. J., & Martin, A. J. (2019). Understanding girls' disengagement: Identifying patterns and the role of teacher and peer support using latent growth modelling. *Journal of Youth and Adolescence, 48*, 979–995. https://doi.org/10.1007/s10964-019-00986-4

Burns, E. C., Collie, R. J., Van Bergen, P., & Martin, A. J. (2022). Intrapersonal and interpersonal psychosocial adjustment resources and achievement. *Journal of Educational Psychology, 114*(8), 1912–1930. https://doi.org/10.1037/edu0000726

Burns, E. C., Martin, A. J., & Collie, R. J. (2018). Adaptability, personal best (PB) goal setting, and gains in students' academic outcomes. *Contemporary Educational Psychology, 53*, 57–72. https://doi.org/10.1016/j.cedpsych.2018.02.001

Burns, E. C., Martin, A. J., & Collie, R. J. (2019). Understanding the role of personal best (PB) goal setting in students' declining engagement: A latent growth model. *Journal of Educational Psychology, 111*, 557–572. https://doi.org/10.1037/edu0000291

Collie, R. J., & Martin, A. J. (2023). Teacher wellbeing and relatedness with students: Examining associations over one school term. *Teaching and Teacher Education, 132* (2023), Article 104233. https://doi.org/10.1016/j.tate.2023.104233

Collie, R. J., Martin, A. J., Bottrell, D., Armstrong, D., Ungar, M., & Liebenberg, L. (2017). Academic adversity, contextual support, and academic buoyancy: A person-centered analysis and implications for academic outcomes. *Educational Psychology, 37*(5), 550–564. https://doi.org/10.1080/01443410.2015.1127330

Collie, R. J., Martin, A. J., Flesken, A., & McCourt, B. (2023). Personal agency among students from low socio-economic backgrounds: An examination of student profiles, perceived teaching support, and achievement. *Social Psychology of Education, 2023*, 1–32. https://doi.org/10.1007/s11218-023-09881-0.

Downer, J., Sabol, T. J., & Hamre, B. (2010). Teacher-child interactions in the classroom. *Early Education & Development, 21*(5), 699–723. https://doi.org/10.1080/10409289.2010.497453

Eccles, J. S., Lord, S., & Midgley, C. (1991). What are we doing to early adolescents? The impact of educational contexts on early adolescents. *American Educational Research Journal, 99*, 521–542. https://doi.org/10.1086/443996

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values and goals. *Annual Review of Psychology, 53*, 109–132.

Eccles, J. S., & Wigfield, A. (2020). From expectancy-value theory to situated expectancy-value theory. *Contemporary Educational Psychology, 61*, Article 101859. https://doi.org/10.1016/j.cedpsych.2020.101859

Eccles, J. S., Wigfield, A., & Byrnes, J. (2003). Cognitive development in adolescence. In R. M. Lerner, M. A. Easterbrooks, & J. Mistry (Eds.), *Handbook of psychology* (pp. 325–350). American Psychological Association. https://doi.org/10.1002/0471264385.wei0613.

Eid, M., Gollwitzer, M., & Schmitt, M. (2010). *Statistik und forschungsmethoden [Statistics and research methods]* (1st ed.). Beltz PVU.

Enders, C. K. (2010). *Applied missing data analysis*. Guilford.

Evans, D., Borriello, G. A., & Field, A. P. (2018). A review of the academic and psychological impact of the transition to secondary education. *Frontiers in Psychology, 9*, 1482. https://doi.org/10.3389/fpsyg.2018.01482

Fan, H., Xu, J., Cai, Z., He, J., & Fan, X. (2017). Homework and students' achievement in math and science. *Educational Research Review, 20*, 35–54. https://doi.org/10.1016/j.edurev.2016.11.003

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement. *Review of Educational Research, 74*(1), 59–109. https://doi.org/10.3102/00346543074001059

Fredricks, J. A., & Eccles, J. S. (2002). Children's competence and value beliefs from childhood through adolescence. *Developmental Psychology, 38*, 519–533. https://doi.org/10.1037/0012-1649.38.4.519

Gentrup, S., Lorenz, G., Kristen, C., & Kogan, I. (2020). Self-fulfilling prophecies in the classroom: Teacher expectations, teacher feedback and student achievement. *Learning and Instruction, 66*, Article 101296. https://doi.org/10.1016/j.learninstruc.2019.101296

Goldstein, H. (2003). *Multilevel statistical models* (3rd ed.). Hodder Arnold.

Granziera, H., Liem, G. A. D., Chong, W. H., Martin, A. J., Collie, R. J., Bishop, M., et al. (2022). The role of teachers' instrumental and emotional support in students' academic buoyancy, engagement, and academic skills. *Learning and Instruction, 80*, Article 101619. https://doi.org/10.1016/j.learninstruc.2022.101619

Green, J., Martin, A. J., & Marsh, H. W. (2007). Motivation and engagement in English, mathematics and science high school subjects: Towards an understanding of multidimensional domain specificity. *Learning and Individual Differences, 17*, 269–279. https://doi.org/10.1016/j.lindif.2006.12.003

Hamre, B. K., Pianta, R. C., Downer, J. T., DeCoster, J., Mashburn, A. J., Jones, S. M., et al. (2013). Teaching through interactions. *The Elementary School Journal, 113*(4), 461–487. https://doi.org/10.1086/669616

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77*, 81–112. https://doi.org/10.3102/003465430298487

Hickey, D. T., & Granade, J. B. (2004). The influence of sociocultural theory on our theories of engagement and motivation. In D. McInerney, & S. Van Etten (Eds.), *Big theories revisited* (pp. 200–223). Information Age Publishing.

Hidi, S., & Renninger, K. A. (2006). The four-phase model of interest development. *Educational Psychologist, 41*(2), 111–127. https://doi.org/10.1207/s15326985ep4102_4

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis. *Structural Equation Modeling, 6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Jang, H., Reeve, J., & Deci, E. L. (2010). Engaging students in learning activities: It is not autonomy support or structure but autonomy support and structure. *Journal of Educational Psychology, 102*(3), 588–600. https://doi.org/10.1037/a0019682

Jungert, T., Levine, S., & Koestner, R. (2020). Examining how parent and teacher enthusiasm influences motivation and achievement in STEM. *The Journal of Educational Research, 113*(4), 275–282.

Kiuru, N., Wang, M., Salmela-Aro, K., Kannas, L., Ahonen, T., & Hirvonen, R. (2020). Associations between adolescents' interpersonal relationships, school well-being, and academic achievement during educational transitions. *Journal of Youth and Adolescence, 49*, 1057–1072. https://doi.org/10.1007/s10964-019-01184-y

Klem, A. M., & Connell, J. P. (2004). Relationships matter: Linking teacher support to student engagement and achievement. *Journal of School Health, 74*, 262–273. https://doi.org/10.1111/j.1746-1561.2004.tb08283.x

Kline, R. B. (2016). *Principles and practice of structural equation modeling*. Guilford Press.

Lam, C. B., McHale, S. M., & Crouter, A. C. (2014). Time with peers from middle childhood to late adolescence. *Child Development, 85*(4), 1677–1693. https://doi.org/10.1111/cdev.12235

Lerner, R. M., Dowling, E. M., & Anderson, P. M. (2003). Positive youth development. *Applied Developmental Science, 7*(3), 172–180. https://doi.org/10.1207/S1532480XADS0703_8

Liem, G. A., & Martin, A. J. (2012). The Motivation and Engagement Scale: Theoretical framework, psychometric properties, and applied yields. *Australian Psychologist, 47*, 3–13. https://doi.org/10.1111/j.1742-9544.2011.00049.x

Little, T. D., Slegers, D. W., & Card, N. A. (2006). A non-arbitrary method of identifying and scaling latent variables in SEM and MACS models. *Structural Equation Modeling, 13*(1), 59–72. https://doi.org/10.1207/s15328007sem1301_3

Martin, A. J. (2012). Motivation and engagement: Conceptual, operational and empirical clarity. Section Commentary. In S. Christenson, A. Reschly, & C. Wylie (Eds.), *Handbook of research on student engagement* (1st ed.). Springer.

Martin, A. J. (2022). The role of academic engagement in mediating the link between instruction and academic outcomes: New insights from load reduction instruction and the 4M Academic Engagement Framework. In S. Christenson, & A. Reschly (Eds.), *Handbook of research on student engagement* (2nd ed.). Springer.

Martin, A. J. (2023). Integrating motivation and instruction. *Educational Psychology Review, 2023*, 35–54. https://doi.org/10.1007/s10648-023-09774-w

Martin, A. J., Balzer, B., Garden, F., Handelsman, D. J., Hawke, C., Luscombe, G., et al. (2022). The role of motivation and puberty hormones in adolescents' academic engagement and disengagement. *Learning and Individual Differences, 100*, Article 102213. https://doi.org/10.1016/j.lindif.2022.102213

Martin, A. J., Burns, E. C., Collie, R. J., Bostwick, K. C. P., Flesken, A., & McCarthy, I. (2022). Growth goal setting in high school. *Journal of Educational Psychology, 114*(4), 752–771. https://doi.org/10.1037/edu0000682

Martin, A. J., Collie, R. J., Stephan, M., Flesken, A., Halcrow, F., & McCourt, B. (2024). The role of teaching support in assisting students' transition to high school. *Learning and Individual Differences, 109*, Article 102382. https://doi.org/10.1016/j.lindif.2023.102382.

Martin, A. J., & Dowson, M. (2009). Interpersonal relationships, motivation, engagement, and achievement. *Review of Educational Research, 79*(1), 327–365. https://doi.org/10.3102/0034654308325583

Martin, A. J., & Evans, P. (2018). Load reduction instruction: Exploring a framework that assesses explicit instruction through to independent learning. *Teaching and Teacher Education, 73*, 203–214. https://doi.org/10.1016/j.tate.2018.03.018

Martin, T. G., Martin, A. J., & Evans, P. (2017). Student engagement in the Caribbean region: Exploring its role in the motivation and achievement of Jamaican middle school students. *School Psychology International, 38*, 184–200.

Martin, A. J., & Steinbeck, K. (2017). The role of puberty in students' academic motivation and achievement. *Learning and Individual Differences, 53*, 37–46. https://doi.org/10.1016/j.lindif.2016.11.003

Martin, A. J., Way, J., Bobis, J., & Anderson, J. (2015). Exploring the ups and downs of mathematics engagement in the middle years of school. *The Journal of Early Adolescence, 35*, 199–244. https://doi.org/10.1177/0272431614529365

McNeish, D. (2018). Thanks coefficient alpha, we'll take it from here. *Psychological Methods, 23*(3), 412–433. https://doi.org/10.1037/met0000144

Muthén, L. K., & Muthén, B. O. (2022). *Mplus user's guide*. Muthén & Muthén.

National Assessment Program. (2016). *Naplan. Acara*.

Peterson, R. A., & Brown, S. P. (2005). On the use of beta coefficients in meta-analysis. *Journal of Applied Psychology, 90*(1), 175–181. https://doi.org/10.1037/0021-9010.90.1.175

Pianta, R. C., & Hamre, B. K. (2009). Conceptualization, measurement, and improvement of classroom processes. *Educational Researcher, 38*(2), 109–119. https://doi.org/10.3102/0013189X09332374

Pintrich, P. R. (2003). A motivational science perspective on the role of student motivation in learning and teaching contexts. *Journal of Educational Psychology, 95*(4), 667–686. https://doi.org/10.1037/0022-0663.95.4.667

Pitzer, J., & Skinner, E. (2017). Predictors of changes in students' motivational resilience over the school year: The roles of teacher support, self-appraisals, and emotional reactivity. *International Journal of Behavioral Development, 41*(1), 15–29. https://doi.org/10.1177/0165025416642051

Ramdass, D., & Zimmerman, B. J. (2011). Developing self-regulation skills. *Journal of Advanced Academics, 22*(2), 194–218. https://doi.org/10.1177/1932202X1102200202

Reeve, J. (2012). A self-determination theory perspective on student engagement. In S. L. Christenson, A. L. Reschly, & C. Wylie (Eds.), *Handbook of research on student engagement* (pp. 149–172). Springer.

Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance. *Psychological Bulletin, 138*(2), 353–387. https://doi.org/10.1037/a0026838

Rickert, N. P., & Skinner, E. A. (2022). Parent and teacher warm involvement and student's academic engagement. *British Journal of Educational Psychology, 92*(2), 667–687. https://doi.org/10.1111/bjep.12470

Rimm-Kaufman, S. E., Baroody, A. E., Larsen, R. A., Curby, T. W., & Abry, T. (2015). To what extent do teacher-student interaction quality and student gender contribute to fifth graders' engagement in mathematics learning? *Journal of Educational Psychology, 107*(1), 170–185. https://doi.org/10.1037/a0037252

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory*. Guilford Press. https://doi.org/10.1521/978.14625/28806

Schafer, J. L., & Graham, J. W. (2002). Missing data. *Psychological Methods, 7*(2), 147–177. https://doi.org/10.1037/1082-989X.7.2.147

Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *Journal of Educational Psychology, 85*(4), 571–581. https://doi.org/10.1037/0022-0663.85.4.571

Skinner, E. A., & Pitzer, J. R. (2012). Developmental dynamics of student engagement, coping, and everyday resilience. In S. L. Christenson, A. L. Reschly, & C. Wylie (Eds.), *Handbook of research on student engagement* (pp. 21–44). Springer.

Skinner, E. A., Zimmer-Gembeck, M., & Connell, J. P. (1998). Individual differences and the development of perceived control. *Monographs of the Society for Research in Child Development, 63*(2–3), 220. https://doi.org/10.2307/1166220

The Learning Bar. (2019). Tell them from Me survey. https://thelearningbar.com/about-us/?lang=aue.

Trautwein, U., Lüdtke, O., Schnyder, I., & Niggli, A. (2006). Predicting homework effort: Support for a domain-specific, multilevel homework model. *Journal of Educational Psychology, 98*(2), 438–456. https://doi.org/10.1037/0022-0663.98.2.438

Van Ryzin, M. J., Gravely, A. A., & Roseth, C. J. (2009). Autonomy, belongingness, and engagement in school as contributors to adolescent psychological well-being. *Journal of Youth and Adolescence, 38*(1), 1–12.

Wang, S., Rubie-Davies, C. M., & Meissel, K. (2018). A systematic review of the teacher expectation literature over the past 30 years. *Educational Research and Evaluation, 24*(3–5), 124–179. https://doi.org/10.1080/13803611.2018.1548798

Wickrama, K. A. S., Lee, T. K., O'Neal, C. W., & Lorenz, F. O. (2016). *Higher order growth curves and mixture modeling with Mplus*. Routledge. https://doi.org/10.4324/9781315642741

Wigfield, A., & Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology, 25*(1), 68–81. https://doi.org/10.1006/ceps.1999.1015

Wigfield, A., Tonks, S. M., & Klauda, S. L. (2016). Expectancy-value theory. In K. R. Wentzel, & D. B. Miele (Eds.), *Handbook of motivation at school* (pp. 55–74). Routledge.

Willms, J. D. (2014). Student engagement in New South Wales secondary schools. *Learning*.

Wong, T. K., Tao, X., & Konishi, C. (2018). Teacher support in learning. *Issues in Educational Research, 28*(1), 202–219.

World Health Organization. (2023). Adolescent health. https://www.who.int/health-topics/adolescent-health#tab=tab_1. (Accessed 6 July 2023).

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