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REVIEW AND SYNTHESIS

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Student engagement declines across adolescence: A meta-analysis of longitudinal studies

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Abstract

Stage-environment fit theory proposes that student engagement declines across adolescence as school environments increasingly fail to meet adolescents' developing psychological needs. Grounded in the stage-environment fit perspective, the current study used a systematic search and meta-analysis to examine the average change in student engagement in adolescence. Articles had to include longitudinal repeated measurements of student engagement in adolescence (age 10–18 years). Using eight search databases, we uncovered 1623 unique records. After a title and abstract screen, we retained 264 studies for full-text screening. The final dataset included 125 studies containing 223 repeated measurements of engagement that allowed for computation of 544 effect sizes. Across the constructs of behavioural, emotional, cognitive and academic engagement, there was a general decline in engagement across adolescence ($\Delta = -0.09$, $p < 0.001$). Engagement changed most negatively in earlier adolescence ($b = 0.03$, $p < 0.001$) and for adolescents experiencing a school transition ($b = -0.15$, $p < 0.01$). Change in

engagement was not impacted by study date of publication, the type of engagement measured, nor by adolescent gender.

KEYWORDS
academic engagement, adolescence, meta-analysis, school engagement, student engagement

Context and implications

Rationale for this study: Stage-environment fit theory proposes that student engagement declines across adolescence. A meta-analysis of changes in student engagement is needed to test this assumption across studies.

Why the new findings matter: This meta-analysis produces conclusive evidence that, on average, student engagement declines across adolescence. This is the first synthesis of the international literature on this topic.

Implications for research and practice: The main finding that student engagement declines across diverse samples and contexts provides a basis for further research into the fundamental developmental and educational mechanisms behind change in student engagement. Educators and educational policymakers should note that transitions in early adolescence are likely to precipitate and deepen declines in student engagement.

INTRODUCTION

Engaging in school, classwork, subjects and academic tasks is an important gateway to learning and achievement in adolescence. Student engagement has emotional, cognitive and behavioural aspects that are studied longitudinally as separate dimensions, for example, enjoyment of school, cognitive effort in studies, and attendance in class. Stage-environment fit theory proposes that student engagement declines across adolescence as school environments increasingly fail to meet adolescents' developing psychological needs. However, studies document varied trajectories of adolescent student engagement (Datu et al., 2022; Wang et al., 2022), therefore, it is not known whether declines in student engagement are normative in adolescence. To investigate this issue, the current study sought to describe the development of student engagement in adolescence using a systematic search and meta-analysis. The results of the current study aim to inform researchers, educational practitioners and educational policy makers about how different forms of student engagement typically develop across adolescence.

Student engagement in adolescence

Conceptualising student engagement

In this review we define student engagement as a student's involvement in education, schooling and schoolwork, in line with a multi-tiered perspective on student engagement posited

by Skinner and Pitzer (2012). The construct of student engagement has emotional, cognitive and behavioural dimensions, for example focused attention on classroom tasks and attending school (behavioural), feelings about school (emotional) and cognitive processes involved in schoolwork (cognitive) (e.g., Fredricks et al., 2004).

A recent review of student engagement as a construct (Wong & Liem, 2022) documented many aspects of psychological functioning that fall within and across cognitive, emotional, and behavioural dimensions of student engagement. Some examples include participation and persistence in schooling, sense of belonging at school, motivation towards schooling, absorption in schoolwork, emotional experiences of schooling, psychological investment in school, cognitive learner strategies, agentic control over school processes and social involvement in schooling. Other individual academic emotions also fit within the construct of student engagement, including interest, curiosity and excitement about schooling and schoolwork. Across the literature on student engagement and motivation, these multiple perspectives have never been mapped systematically. This situation of unknown and potentially limitless search terms presents a challenge for systematic reviews of student engagement. Accordingly, in this review we focus narrowly on studies that use the term 'student engagement' and direct synonyms for the overarching construct.

It is also important to note that the student engagement literature has critically developed across the past few decades to a point where scholars are much clearer about which aspects of social and psychological functioning do not fit within the engagement construct (Skinner, 2016). For example, in conceptual and measurement models, the quality of relationships with peers and teachers is considered to be an antecedent or outcome of student engagement, rather than an indicator of student engagement (Skinner, 2016). This precision has enabled a more sensitive mapping of the student engagement literature (Salmela-Aro et al., 2022; Wong & Liem, 2022) to advance theory and empirical research.

Another feature of the student engagement construct is that it can be conceptualised at different levels of agent, task and time, whereby single to multiple agents engage in narrower to broader tasks across momentary to longitudinal time (Symonds, Kaplan, et al., 2025). For example, engagement can be conceptualised and studied as an individual student focusing on a mathematics task in class. In this example, the agent, task and time coincide at the microlevel of measurement and conceptualisation. Alternatively, at the macrolevel of agent, task, and time, student engagement can also be studied in large samples as the development of attitudes to education measured across many years. In this review, we are interested in student engagement occurring at a range of levels of agent and task, across the longitudinal timespan of adolescence.

Reviews of student engagement

There is a growing corpus of reviews on student engagement in adolescence. Previous reviews have focused on the definitions used by student engagement researchers (e.g., Eccles, 2016; Fredricks et al., 2004), have sought to clarify engagement as a construct (e.g., Skinner, 2016; Wong & Liem, 2022), have detailed the role of engagement in development (e.g., Wang et al., 2019) and have summarised certain perspectives on engagement research (Wang & Degol, 2014). There are also reviews of specific engagement topics such as engagement in science education (e.g., Aker & Ellis, 2019; Sinatra et al., 2015) and the relationships between engagement and academic achievement (Lei et al., 2018; Wong et al., 2024) and between engagement and wellbeing (Wong et al., 2024). These reviews have provided a broad conceptual and empirical basis for understanding student engagement. However, no review has systematically analysed how student engagement develops across adolescence.

In the field of motivation research, Scherrer and Preckel (2019) conducted a meta-analysis of the development of a range of motivational variables and self-esteem, across childhood and adolescence. This study found that there was an average decrease in the measured variables with age. Intrinsic motivation and academic self-concept declined the most, whereas self-esteem and academic self-efficacy were more stable. These findings demonstrate that motivational variables, rather than self-beliefs, are more vulnerable during adolescence, which supports the need for meta-analyses of similar variables such as those captured within the emotional and cognitive dimensions of engagement (e.g., enjoyment of schooling, perseverance).

The development of student engagement in adolescence

Significance and previous mapping

The development of student engagement in adolescence is of great interest to researchers studying how attitudes and behaviours form in relation to the school environment. There are practical applications of how student engagement typically develops for educators wishing to improve aspects of the school social and academic climate to encourage school engagement in adolescence (e.g., Fredricks et al., 2019). Furthermore, when students engage at higher, stable levels with schooling across adolescence, or have increasing school engagement across adolescence, this has long-term benefits for their mental health, education, and employment in young adulthood (Symonds et al., 2016) and middle adulthood (Symonds et al., 2023). Therefore, studying how engagement typically develops across adolescence is important for understanding how person-environment interactions within school contexts are shaping adolescents' life chances during adolescence and across the life course.

In line with the important theoretical and practical implications of the development of student engagement in adolescence, researchers have begun to systematically analyse the literature on this topic. A recent scoping review (Salmela-Aro et al., 2022) mapped the research field. Salmela-Aro et al. (2022) found that most studies of adolescent student engagement development (93% of 104) investigated antecedents of engagement development (e.g., gender, age, achievement and relationships) whilst fewer studies (38%) focused on outcomes of engagement development (e.g., educational goals, achievement). The review also documented that most studies of engagement development took measurements across annual time intervals, with fewer studies taking measurements across smaller intervals of weeks to months. This first ever scoping review of longitudinal studies of student engagement in adolescence (Salmela-Aro et al., 2022) has begun the mapping work that our meta-analysis extends through statistical analysis of study results.

Stage-environment fit theory

Since the 1980s, Eccles and colleagues have been studying changes in school motivation and engagement across adolescence. In their early review, Eccles and Midgley (1989) proposed that declines in student engagement might be attributed to the changes that students experienced in the school environment as they transferred from elementary to middle school in the US. These environmental changes typically included greater bureaucracy, less personal relationships between teachers and students, less autonomy for students and greater social comparison in classrooms (Eccles & Midgley, 1989). Drawing on earlier person-environment interaction work by Hunt (1975), Eccles and Midgley (1989) proposed that the environmental changes at school transition were a poor fit with early adolescents'

developing psychological and social needs such as increased peer orientation, increased salience of identity issues, increased cognitive capacity, greater need for autonomy and increased self-focus and self-consciousness. The theory was developed with respect to early adolescents (age 10–12 years) but also has relevance for students in mid adolescence (age 13–15 years) and late adolescence (age 16–18 years) (Liu et al., 2022).

Although stage-environment fit theory was developed in the US educational context, it has international application. Across Europe, many countries have education systems where students transition from first level education to lower secondary education at around age 12-years, with a further transition to upper secondary education at around age 15-years (European Commission, 2021). Other education systems have a single transition from first to second level education between the ages of 11-years (i.e., the United Kingdom) and 15-years (i.e., Finland) (European Commission, 2021). Furthermore, many of the age-graded changes in school environment observed at the US elementary to middle school transition, such as the increased focus on academic achievement and the change from a single classroom teacher to multiple subject specialist teachers, are common to other school systems internationally including the United Kingdom (Symonds & Hargreaves, 2016), Australia (Nielsen et al., 2017) and Hong Kong (Forlin et al., 2013). This presents an international landscape where most adolescents experience a school transition accompanied by a change in school environments, but also where some adolescents have no school transition depending on the education system.

Mechanisms of declines in student engagement

The mechanisms by which student engagement declines in adolescence are broadly categorised by Symonds and Hargreaves (2016). First, it is posited that there is a *normative decline* in student engagement across adolescence due to developmental changes in adolescents' attitudes towards school and learning. Second, as proposed in stage-environment fit theory (Eccles et al., 1993), adolescents' attitudes can decline due to *changes in the school environment at school transition*. New environmental factors in the transition school provide altered and new resources and demands that interact with adolescents' mental health, wellbeing and engagement (Salmela-Aro et al., 2022). Third, adolescents' attitudes might decline due to *changes in the person at school transition*, i.e., as adolescents restructure their attitudes and behaviours in response to the new environmental factors. Fourth, there might be an *interaction between the normative decline and school transition*, which deepens adolescents' loss of engagement with schooling. These four mechanisms complement stage-environment fit theory by highlighting the variation in how interactions between the school environment and adolescent development may drive and deepen declines in student engagement across time.

Moderators of student engagement trajectories

Below we discuss relevant moderators of student engagement trajectories that should be considered in a meta-analysis. The first important set of moderators is the type of engagement. As discussed, a common conceptualisation is that engagement has cognitive, emotional and behavioural dimensions (Fredricks et al., 2004; Wong & Liem, 2022). Prior research finds that change in student engagement varies depending on the engagement dimension. Within an individual sample of US adolescents, Wang and Eccles (2012) found that across Grades 7 to 11, school belonging (representing emotional engagement) declined the most, followed by school participation (representing behavioural engagement).

Self-regulated learning (representing cognitive engagement) declined the least. The researchers also found differential impacts of the engagement dimension trajectories on Grade Point Average (GPA), with the decline in school participation being the most predictive. Although the authors did not speculate on why the engagement dimensions changed at different rates, stage-environment fit theory supports the notion that emotional engagement is most vulnerable to change. This is because adolescents' feelings about school are closely impacted by changes in the school environment that mismatch with their developmental needs (Symonds & Hargreaves, 2016). In turn, reduced emotional engagement may lead to a loss of enthusiasm to participate in learning and school.

A further important moderator of student engagement change may be school transition due to the potential mismatch between the changes in the school environment and developing adolescent needs (Eccles et al., 1993). Gender is also an important potential moderator. By cataloguing student gender balance within and across samples, it is possible for us to test whether being male or female impacts the trajectories of student engagement in adolescence. Individual studies have observed gender differences in levels of student engagement within time points, but limited impact of gender on student engagement trajectories (Wang & Eccles, 2012). It is also possible to test whether different educational and cultural systems help define trajectories at the macrolevel of geographic location. The methodological characteristics of studies can also be tested for potential moderating effects due to study design. Methodological moderators include the starting point of measurement i.e., the age or grade that adolescents were first studied, the time lag between measurements e.g., whether measurements were monthly or annual, and whether the measurements of student engagement were previously validated. This rich set of moderators suited for a meta-analysis of student engagement trajectories enriches the value of studying student engagement across adolescence using meta-analytic techniques.

CURRENT STUDY

Studies have documented declines in student engagement across adolescence, but there is no quantitative synthesis of their results; therefore, it is not possible for researchers to generalise about whether declines observed in individual studies are normative across adolescent samples. To address this gap in knowledge, the current study performs a meta-analysis of longitudinal studies of student engagement in adolescence to provide clarity on the typical trajectories of student engagement in adolescence. The first research question is: how does student engagement typically develop across adolescence? Based on stage-environment fit theory (Eccles et al., 1993) and on the results of Scherrer and Preckel's (2019) meta-analysis of change in motivation, we expected that there would be a general decline in engagement across adolescence.

To perform a robust analysis, we wanted to take account of key study characteristics that could bias the meta-regression results. Accordingly, we sought to ascertain whether change in student engagement was related to the year of publication, location of the sample (e.g., Europe, North America), measurement time lag (e.g., the interval between measurements), age/grade of first measurement and type of report (student, parent, teacher, observer). We also sought to control for any significant study key characteristics in the ensuing moderator analysis. Therefore, our second research question is: how do study key characteristics impact change in student engagement?

Given that the development of student engagement in adolescence is predominantly measured using the constructs of emotional, cognitive, and behavioural engagement, with a few studies using other constructs including agentic engagement and academic engagement (Salmela-Aro et al., 2022), we then aimed to examine whether the change in engagement

was impacted by the measured construct. Accordingly, our third research question is: how does the measured engagement construct impact change in student engagement? Following studies of emotional, behavioural and cognitive engagement that measure change within the same sample (Li & Lerner, 2011; Wang & Eccles, 2012), we expected to see the most change in emotional engagement, followed by behavioural engagement, and then by cognitive engagement.

Gender was also tested as a moderator of engagement trajectories, based on the substantial but mixed evidence base regarding gender differences in school engagement. This is expressed as our fourth research question: how does adolescent gender impact change in student engagement?

The study is informed by stage-environment fit theory which proposes that engagement declines are caused in part by changes in person-environment fit experienced across school transition. In line with stage-environment fit assumptions, we included samples of adolescents with and without a school transition. Our fifth research question is therefore: how does school transition impact change in student engagement?

Stage-environment fit theory also emphasises that the fit between adolescents' psychosocial needs and school environment differs with age. For example, early adolescents transferring from elementary to middle school, or the equivalent primary to secondary school, could encounter a different set of continuities and discontinuities in school environment (Symonds et al., 2023) compared to adolescents transferring from middle school to junior high school where the environmental structure of subject specialist teachers and larger school rolls is already established. Therefore, our final research question is: is change in school engagement moderated by school grade? Together, the research questions aim to describe the typical change in student engagement occurring across adolescence, and whether that change is linked to environmental, individual and methodological factors.

METHOD

A quantitative meta-analysis was chosen for the research design, to fulfil the objectives of synthesising quantitative data on observed change in student engagement and testing the effect of potential moderators. Systematic literature review methods were used to identify, screen and appraise studies for the meta-analysis, to create a rigorous and comprehensive database of study characteristics and statistical results. The analysis plan and inclusion of several moderators (such as gender and school transition) were informed by the meta-analysis of Scherrer and Preckel (2019).

Inclusion and exclusion criteria

Measurement of student engagement

All types of student engagement conceptualisations and measures were included in our review, provided they fit with the notion of engagement as a multidimensional construct comprised of multiple internal components (Fredricks et al., 2004; Symonds, Kaplan, et al., 2025; Wong & Liem, 2022). An important criterion was that studies had to represent student engagement with their measurements, rather than focus on related constructs such as achievement goal orientation or school peer group quality. This logic followed Skinner's (2016) observation that it is necessary to distinguish what belongs inside the engagement construct versus what belongs outside the engagement construct, with researchers often confusing covariates, predictors and outcomes of engagement. Accordingly, the measures of student engagement

that emerged during our screening were either purposefully designed to capture engagement as a multidimensional construct (e.g., The Student Engagement Instrument; Appleton et al., 2006) or were selected to represent individual components of engagement (e.g., academic effort representing cognitive engagement).

Measurement timeframe

To be included in the meta-analysis, studies had to measure student engagement at two or more time-points during adolescence (age 10–18-years), using repeated measurements. The timespan of studies needed to be longitudinal, with the minimum interval of measurement being days to weeks rather than seconds to hours. Experience sampling studies of student engagement occurring at random intervals were not included, as these studies did not fit with the framework of longitudinal repeated measurements.

Publication language

Studies had to be published in English. These last criteria allowed the study authors to screen and review the articles using English as their common language and created a basic quality threshold of blinded peer review (articles were screened using a quality appraisal tool later in the process).

Study quality

Finally, studies had to be published in peer-reviewed journal articles. We did not include conference papers, reports, books, book chapters, or dissertations. We restricted the meta-analysis to peer-reviewed journal articles so that all quantitative data were sourced from a pool of resources that had a similar high standard of scientific rigour.

Systematic search

The search was conducted in July 2022. Five databases were selected based on their relevance to educational and educational psychology research: PsychInfo, ProQuest Education, Educational Research Information Centre, Australian Education base and Scopus. A search string was applied to each database where Boolean terms were used to connect lists of synonyms for student engagement, longitudinal and adolescence (Table 1). Search results were downloaded into Microsoft Excel. The search yielded 2563 records with 1623 records after duplicates were removed (Figure 1).

Screening

Nine researchers contributed to the screening and data extraction. Microsoft Excel was used to manage the screening. A test screen was conducted on 5 randomly selected records, with screeners working independently to assess the record titles and abstracts according to the main two inclusion criteria of (i) longitudinal measure of student engagement and (ii) adolescent sample. Each criterion was scored using no, maybe, or yes. The screeners met

TABLE 1 Search string.

Construct	Search terms	Boolean
Engagement	'school engagement' OR 'engagement in school*' OR 'student engagement' OR 'pupil engagement' OR 'learner engagement' OR 'emotional engagement' OR 'cognitive engagement' OR 'behavioural engagement' OR 'behavioural engagement' OR 'agentic engagement' OR 'academic engagement' OR 'situational engagement' OR 'momentary engagement'	AND
Longitudinal	longitudinal OR developmental OR cohort OR life-span OR 'life course' OR transition OR long-term OR 'longer term' OR trajector* OR growth OR maturation	AND
Adolescence	child* OR adolescen* OR student* OR youth OR 'young person' OR 'young people' OR pupil*	NOT
	pre-school OR kindergarten OR playschool OR 'nursery school' OR daycare OR 'further education' OR college OR university OR 'third level' OR polytechnic OR 'young adult' OR 'higher education'	

to discuss the results with a focus on improving conceptual alignment between screeners. Next, the 1623 records were randomly allocated to pairs of screeners, with each screener working independently and each record screened twice. Screeners marked records for full text screening if the records were scored as a yes or maybe across both main inclusion criteria. Across pairs of screeners there was an initial 85% agreement and a Kappa statistic of $\kappa = 0.53$. The disagreements over 241 records were resolved by a third person using either verbal mediation or written evaluation to reach 100% agreement. This yielded 264 reports for full text screening. Of the 264 reports, four could not be retrieved. Reports were randomly allocated to the team of screeners and each full text was screened once, with random accuracy checks performed by the lead screener. After full text screening, 165 reports met inclusion criteria.

Next, the team performed a data screen to assess whether each of the 165 reports had the required quantitative data of (i) mean values and standard deviations for the measured engagement construct at each wave and (ii) correlations between the measurements of engagement between all pairs of waves (e.g., W1 and W2, W2 and W3, W1 and W3). Eighty-three reports were followed up to obtain some or all the required data. Authors were contacted via email and were given two reminders across three weeks. Data were retrieved for 57 reports with missing data. This yielded a total of 139 reports for data screening. After data screening, 14 reports were excluded due to the data not being suitable for analysis (Figure 1). A total of 125 reports were included in the next stage of data extraction and quality appraisal.

Data extraction

A data extraction framework (Symonds, Guo, et al., 2025) was developed by the research team for capturing data on study characteristics and the engagement measurement across time. The framework built on an existing framework used in Salmela-Aro et al.'s scoping review (Salmela-Aro et al., 2022) to extract data on longitudinal studies of student engagement in adolescence. The variables extracted for analysis are reported in the text below. Microsoft Excel was used to manage the data extraction. The full dataset is available to download from the OSF archive (Symonds, Guo, et al., 2025).

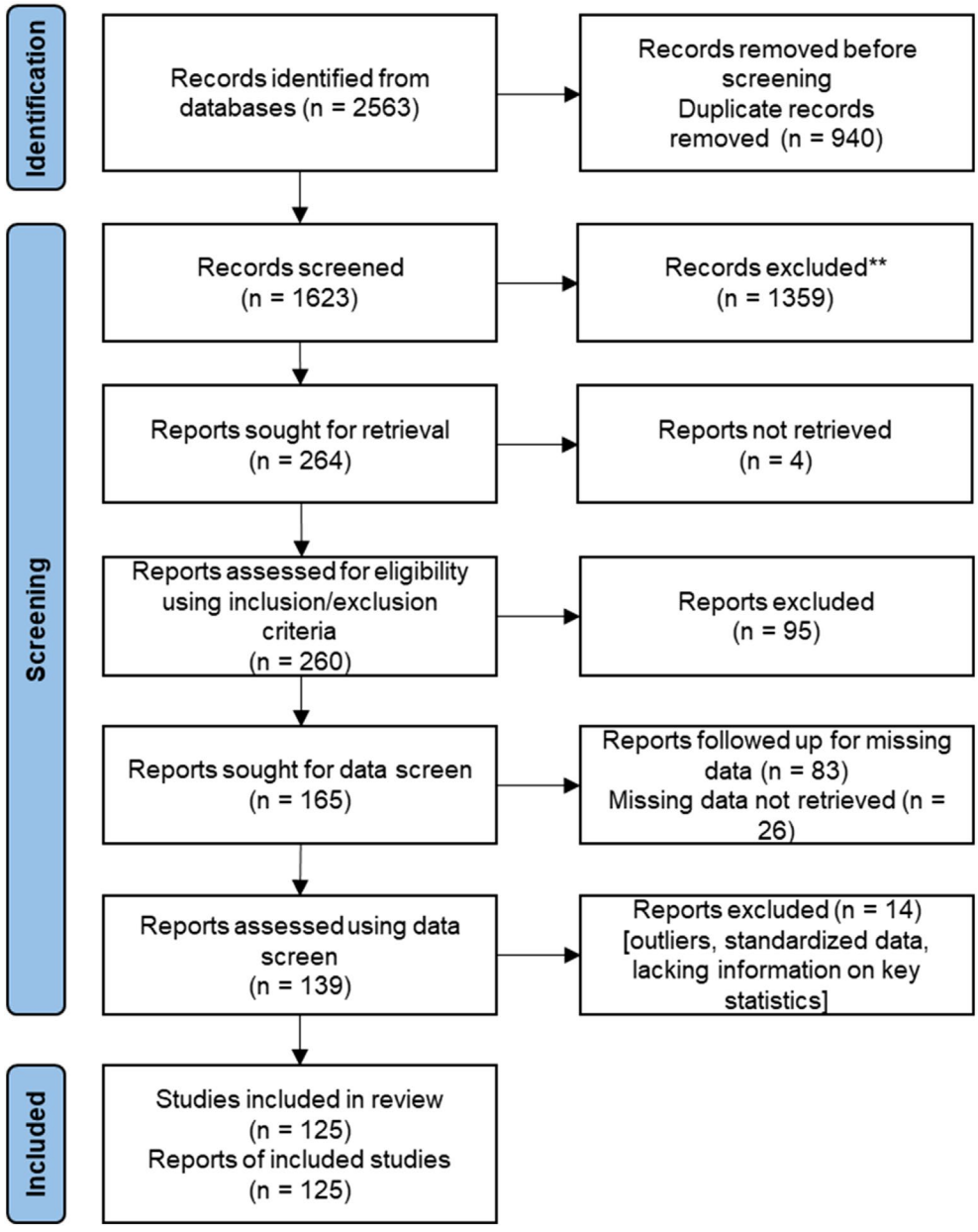

FIGURE 1 PRISMA diagram of search and screening results. PRISMA flow chart adapted for the meta-analysis methodology by including data screening and follow up of missing data steps.

Study quality

A quality review framework (Symonds & Tang, 2024; Tang et al., 2025) was developed specifically for evaluating longitudinal quantitative studies with repeated measures data. The quality review framework was based on Tooth et al. (2005) who developed 33 criteria to assess observational longitudinal research. The current study used seven criteria to assess whether authors had included details about (i) the data collection setting, (ii) the sample characteristics, (iii) the percentage of participants consenting versus recruited, (iv) the logic

behind the target sample size, (v) the number of participants at each wave, (vi) report of missing data at each wave and (vii) validity information on the repeated measurements of engagement. Each criterion was rated using a three-point scale (1 = no information, 2 = partial information, 3 = detailed information). The framework used in the current study has since been expanded to evaluate cross-sectional and longitudinal qualitative, quantitative and mixed methods studies (Tang et al., 2025), and researchers can download the most recent version of the framework as an open access resource (Symonds, Kaplan, et al., 2025). So long as the included studies met the inclusion criteria and had sufficient data to meta-analyse, they were included in the review. Here, the quality review was used to give additional information to the readers regarding the overarching quality of the dataset extracted from the studies. The outcomes of the quality review are reported in the results section.

Study characteristics

The meta-analysis data extraction framework captured data on study characteristics including the year of publication, the number of participants, the numbers of males and females (converted often from percentages), the geographic location of data collection, the school tiers represented across the measurement points (elementary/primary, middle/junior, high/secondary), whether there was a school transition between measurement points (e.g., from primary to secondary school), and the age and grade of participants at baseline. School years/grades reported by non-US studies were converted into US school grades according to the average age of adolescents within the respective school year/grade. We used US school grades as our international standardisation because most studies were conducted in the US, and because in the international educational psychology literature, US grades are often used to refer to school years in other national systems for the purpose of improving understandability for an international audience. Available data on age was used to estimate missing data on grade and vice versa. Where only grade or age ranges were given (e.g., Grades 6–11, ages 11–16) the median value was input (e.g., age 13.5). Grade 4 was the lowest grade entered (age 9/10-years) to restrict the waves of measurements to the adolescent period.

Engagement data

Separate measurements of student engagement were logged on individual rows of the Excel spreadsheet, meaning that there could be multiple rows of data for each publication. Each measurement was scored using a categorical variable of engagement type (1 = mixed, 2 = emotional, 3 = cognitive, 4 = behavioural, 5 = agentic, 6 = other). The mixed engagement category included mean values generated by combining items across engagement dimensions (e.g., cognitive and behavioural; energy, dedication and absorption; 'academic' engagement). We recorded details on whether authors used established measures or designed the items themselves, and the name and reference of established engagement measures. The school subject (e.g., mathematics) was recorded for each measure if relevant. Further details about the measure included scale anchors (high and low) and type of report (self, teacher, parent, peer, observed).

Next, data about the measurement timepoints were recorded. These data included the total number of waves, and the adolescents' age and United States school grade at each wave. The timepoint of data collection at each wave was recorded as years (e.g., 2012) and as a categorical variable representing quarter years (1 = January to March, 2 = April to June, 3 = July to September, 4 = October to December). For example, if the first wave of data was

collected in September 2012, the variable 'year' would be 2012, and the variable 'quarter year' would be 3. Next, we used both variables to create an interval between waves data. For example, if the first timepoint was 2020, September (Wave 1) and the second timepoint was 2021, September (Wave 2), the interval would be 1 (one year). If the third timepoint was 2022, December (Wave 3), the interval between Waves 2 and 3 would be one year plus three months (1.25 years).

Finally, statistical data were extracted for each repeated measure of student engagement. Statistical data included the mean values and standard deviations at each wave, and all between wave correlation coefficients (e.g., wave 1 and wave 2, wave 2 and wave 3, wave 1 and wave 3). When studies reported mean values separately for different groups within the sample (e.g., male and female), we inputted the average mean value across groups to represent the entire sample. When studies reported the measure total score instead of the mean value, we computed a mean value by dividing the measure total score by the number of items.

Analysis

Quality review

The quality review data were imported from Microsoft Excel into IBM SPSS Statistics version 29.0.1.0. The quality review scores for each study were summed to give a total score out of a possible 21. The total quality review scores were assumed to reflect higher versus lower levels of quality across the seven indicators, with seven being the lowest possible score and 21 being the highest possible score. The sum for each study represents a multifaceted construct of quantitative study quality.

Study characteristics

The study characteristics data were imported into IBM SPSS Statistics version 29.0.1.0 and were analysed using descriptive statistics.

Publication bias

A variety of techniques for detecting selective reporting, publication bias and small-study effects are available and are routinely used in research syntheses. Most such techniques are univariate (e.g., the trim and fill test and Egger's regression test), where they assume that each study contributes a single, independent effect size estimate to the meta-analysis. Recommended by Rodgers and Pustejovsky (2021), we ran Egger's regression within the framework of the multilevel meta-analysis. In doing so, we included standard error as a predictor in the multilevel mixed effect metaregression model. We also inspected the funnel plot based on the effect sizes aggregated from the study level, to identify whether the shape of the dataset was more asymmetrical versus symmetrical, with a more symmetrical shape indicating less bias. We also ran a *p*-curve analysis to estimate the skewness and flatness of the effect size distribution, with non-significant results indicating evidential value (i.e., a 'true' effect), and allowing for an estimated power of combined studies. The test outcomes are reported in the results section.

Effect sizes

Based on the extracted information, we calculated Glass's Δ using the single-group, pretest-posttest raw score effect size formula (Morris & DeShon, 2002). The formula requires information concerning the means and standard deviations of a measure at two time points:

$$d = \frac{Mean_{Time\ 2} - Mean_{Time\ 1}}{SD_{Time\ 1}}.$$

When a study had more than two points of measurement, we calculated the effect sizes for each unique pair of these points. For example, in a study featuring three measurement points, we included three separate effect sizes for the changes from wave 1 to wave 2, wave 2 to wave 3, and wave 1 to wave 3: In total, we calculated 544 distinct effect sizes.

When using standardized mean change as effect size, the within-study variance is given by

$$v_i = \frac{2(1 - r_i)}{n_i} + \frac{d_i^2}{2n_i},$$

where d_i is the effect size in study i, n_i is the sample size in study i, and r_i is the correlation between pre- and postscores in study I (Lipsey & Wilson, 2001). Because this correlation is frequently not reported in primary studies, we had to estimate plausible r coefficients for the studies without information of r based on the subsample with reported autocorrelations. Thus, we calculated the average correlations separated by construct and time interval ($a < 1$ year, $b = 1$ year, and $c > 1$ years) and used these average values as estimations for the missing correlations (Scherrer & Preckel, 2019).

Main analysis

The meta-analysis computations were made with R (R Core Team, 2022), using the *metafor* package (Viechtbauer, 2010). We compared scales with different ranges by using the Percentage of Maximum Possible Scores (POMP) method (Cohen et al., 1999). The POMP method standardises units of measurement using percentages. For example, on a scale of 1 to 5, the maximum score (100%) is 5. Whereas, on a scale of 1 to 3, the maximum score (100%) is 3. Therefore, on a five-point scale, a score of 2 represents 40% of the maximum score, whereas on a three-point scale, a score of 2 represents 67% of the maximum score. We used the POMP scores when creating our illustrative figures of engagement trends.

All statistical analyses were computed using Glass's Δ and the moderator variables (e.g., geographic region). To answer the first research question (does student engagement typically decline across adolescence), we used multilevel random-effects meta-regression models to estimate the weighted mean effect size across the studies. Next, to answer our other research questions, we used multilevel mixed-effects meta-regression models to identify whether the weighted mean effect size differed by study key characteristics (e.g., the length of the interval, study geographic location, study respondent), the engagement construct, school transition, school grade and student gender. Due to a lack of available data, school subject was not included as a moderator.

Three-level random-effects models were used to account for sampling variation of the observed effect sizes around the 'true' population effect sizes (Level 1), and variance between effect sizes within the same study (Level 2) and across studies (Level 3). We also ran a

two-level random-effects model ignoring the nonindependence of effect sizes derived from the same. However, the one-sided log-likelihood-ratio tests showed that the two-level model did not perform substantively better than the three-level model (LRT = 149.96, $p < 0.0001$). We also ran a four-level random-effects model where two sources of within-study variance were considered: the variance between effect sizes based on the same measurement waves within the same study (e.g., effect sizes for mean-level change between T1 to T2 for Behavioural engagement and emotion engagement in the same study) and the variance between effect sizes based on different measurement waves within the same study (e.g., effect sizes for mean-level change reflecting engagement from Time 1 to Time 2 and from Time 2 to Time 3, in the same study). However, the likelihood-ratio tests showed that the four-level model did not perform better than the three-level model (LRT = 2.21, $p = 0.137$). Thus, the three-level models were used throughout this study.

In the following results section, we report the outcomes of the publication bias analysis, a descriptive analysis of study characteristics, and the inferential analysis of the engagement data extracted from the studies.

RESULTS

Study quality

The 125 studies were screened for quality using seven criteria, scored on a three point scale, resulting in a minimum score of seven and a maximum score of 21. Scores across studies on each of the criteria ranged from one to three, and the total scores ranged from 11 to 19. The average total score was 16 (SD = 2.06). On average, the study settings and samples were described in detail ($M = 2.61$, 2.70; SD = 0.57, 0.51), as were the validity of the instruments used to measure engagement ($M = 2.74$, SD = 0.54). There was less information reported across studies on the number of participants consenting to participate versus those originally recruited ($M = 2.08$, SD = 0.89), the number of participants at each wave of data collection ($M = 2.36$, SD = 0.81), missing data at the item or participant levels ($M = 2.48$, SD = 0.73), and the statistical rationale for the sample size ($M = 1.33$, SD = 0.52).

Study characteristics

The 125 studies were published between 2006 and 2022 ($M = 2017$, SD = 4). The sample sizes of the individual studies ranged from 46 to 61,878 ($M = 1607$, SD = 5707). Participants' age ranged from 9-years to 16.5-years ($M = 13.09$, SD = 1.77), and their school grade ranged from Grade 4 to Grade 11 ($M =$ Grade 7.40, SD = 1.75). Studies were mainly published in North America (USA and Canada) (42.4%, $N = 53$), followed by Europe (29.6%, $N = 37$), Asia (16.8%, $N = 21$), the Antipodes (New Zealand, Australia and Fiji) (8.8%, $N = 11$), the Middle East (1.6%, $N = 2$) and Africa (0.8% each, $N = 1$). Nine (7%) studies were interventions, and only control group engagement was analysed.

Engagement was measured at a minimum of two waves and a maximum of eight waves ($M = 2.6$, SD = 0.91). The study timescale in most cases was one or more years (60%, $N = 75$), followed by months to one year (42%, $N = 52$), then by days to weeks (0.8%, $N = 1$). No shorter timeframes (e.g., a single 30-minute lesson) were included to maintain our focus on longitudinal studies of student engagement.

Twenty-six percent of studies ($N = 32$) measured engagement across a transition between schools, whereas there was no school transition in 74 per cent of studies ($N = 93$).

Most studies had at least one wave of data collected in lower secondary education (70%), or in upper secondary education (50%). Primary education was the least represented (21%).

Across the 125 studies, there were 223 repeated measurements of engagement. The number of engagement measurements ranged from 1 to 6 per study, with an average of 1.72 measurements (SD = 1.07). Most measurements were of behavioural engagement (35.0%, $N = 78$), followed by mixed engagement (25.1%, $N = 56$), e.g., the *Dimensions of School Engagement Scale* (Archambault & Vandenbossche-Makombo, 2014), emotional engagement (22.9%, $N = 51$), cognitive engagement (13%, $N = 29$), other engagement types (2.7%, $N = 6$), e.g., educational aspirations (Martin & Liem, 2010), and agentic engagement (1.3%, $N = 3$). Most measures were student self-report (87.8%, $N = 195$), with a small number of measures reported by teachers (7.7%, $N = 17$), parents (1.8%, $N = 4$), peers and observers (each 1.4%, $N = 3$).

Publication bias

Results of the multilevel Egger's regression test showed that the effect of standard error, which quantifies funnel asymmetry, was not statistically significant ($\beta = -0.11$, SE = 0.75, $p = 0.886$). This means that the less precise studies did not have larger effect sizes (Figure 2). Inspection of the funnel graphs identified a symmetrical shape typical of nonbiased meta-analytic data sets (see Figure 3 for the funnel plot based on individual effect sizes). Next, the results of the *p*-curve analysis are presented in Figure 4. The right skewness test result was statistically significant, whereas the flatness test result was non-significant. These results suggest that evidential value (a 'true' effect) is present in the meta-analysis. The *p*-curve analysis also showed that the included studies have an estimated power of 99%. Together the results of the Egger's regression test, funnel plots and *p*-curve analysis indicated that the dataset was unbiased and had high evidential value.

Main results

The multilevel meta-regression models included $k = 125$ independent studies with $h = 544$ effect sizes of change between waves.

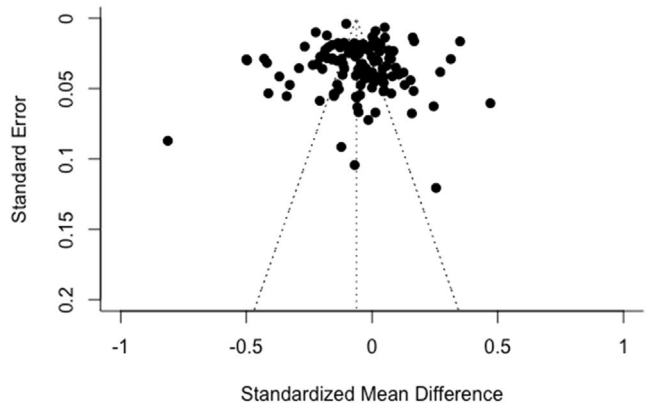

FIGURE 2 Funnel plot of standardised mean differences and standard error.

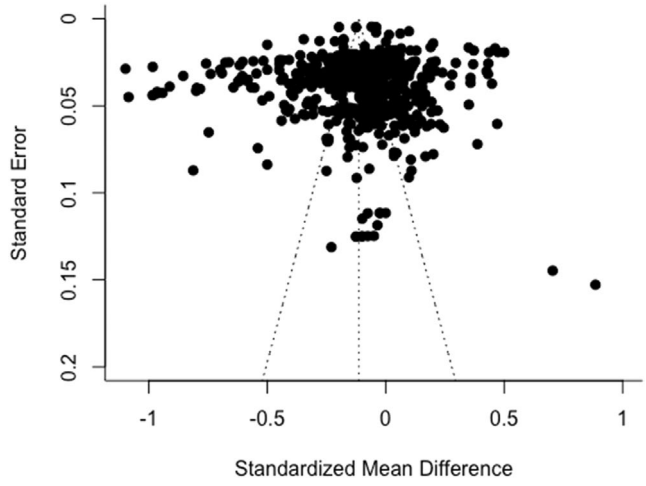

FIGURE 3 Funnel plot based on individual effect sizes.

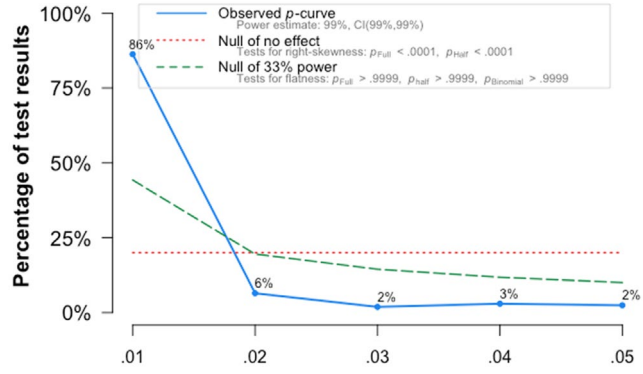

FIGURE 4 P-curve analysis.

Does student engagement typically decline across adolescence?

The multilevel meta-regression analysis of the complete data set indicated a small but significant overall decrease in engagement across the engagement constructs ($\Delta = -0.09$, $p < 0.001$, 95% confidence interval [CI; −0.13, −0.06]). The average interval duration was 1.40 years. That is, on average the mean level of the constructs decreased by 0.09 SD over 1.40 school years in the 125 studies. The trajectories of student engagement measured in each study can be observed in Figure 5.

Is change in student engagement moderated by study key characteristics?

Using multilevel random-effects models (Table 2), we observed that change in engagement was more negative when samples were, in order of impact, European ($k = 36$), North American ($k = 55$), African ($k = 1$), and Middle Eastern ($k = 2$), compared to the total pool of samples that also included adolescents in the Antipodes and Asia. The

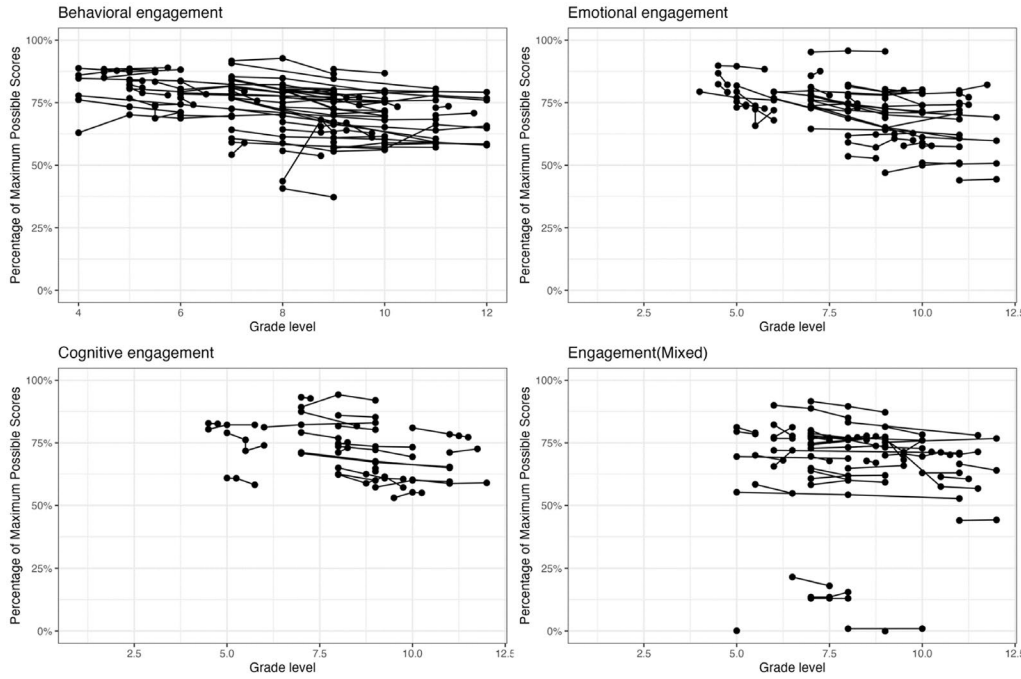

FIGURE 5 Student engagement means across time.

results for African and Middle Eastern samples are weak considering the small number of studies across these regions ($N = 3$), whereas the results for Europe and North America are more robust.

We also found that change in engagement was more pronounced when measurements were student self-report ($k = 111$) compared to other respondent groups (e.g., teachers, peers and parents). There was no difference in change in engagement depending on whether the engagement measurement was previously validated or newly designed by the study authors. Furthermore, there was no impact of year of publication on change in student engagement.

Of importance, we did find that the larger the interval between measurements, the more negative the change in engagement. This effect was apparent in linear and quadratic models. The quadratic term was not significant, whereas the linear term was significant.

Is change in student engagement moderated by the engagement construct?

The number of studies (k) that measured each engagement construct ranged from 3 (agentic engagement) to 68 (behavioural engagement). This pattern corresponded with the number of between-wave estimates of engagement change (h), which ranged from 5 (agentic engagement) to 226 (behavioural). Behavioural, emotional, mixed, and cognitive engagement all declined over time at a similar rate ($F = 0.47$). 'Agentic engagement and 'other' engagement were not related to engagement change; however, this finding must be interpreted with caution because the sample sizes in these two categories were very small. See Table 3 for the full results and Figure 5 for a visual representation of change within each construct.

TABLE 2 Impact of key study characteristics on change in engagement.

Moderator	*k*	*h*	Average effect size *b**(SE)	Lower CI	Upper CI	*F*(df 1, df 2)
Area	125	544				*F*(6,537) = 2.37*
Europe	36	191	−0.15 (0.03)***	−0.21	−0.10	
North America	55	210	−0.11 (0.03)***	−0.16	−0.05	
Antipodes	11	27	−0.00 (0.06)	−0.12	0.11	
Asia	22	74	0.01 (0.03)	−0.06	0.07	
Middle east	2	38	−0.07 (0.03)*	−0.12	−0.01	
Africa	1	4	0.15 (0.04)*	0.02	0.28	
Report type	125	544				*F*(4, 539) = 1.39
Self	111	472	−0.11 (0.02)***	−0.14	−0.07	
Observed	3	5	0.02 (0.11)	−0.27	0.31	
Parent	3	8	0.01 (0.10)	−0.22	0.24	
Teacher	11	52	−0.04 (0.05)	−0.14	0.06	
Peer	2	7	−0.05 (0.13)	−0.37	0.28	
Scale (Validated/ Non-Validated)	125	544	0.05 (0.04)	−0.03	0.13	*F*(1, 542) = 1.59
Publication year	125	544	−0.00 (0.00)	−0.01	0.01	*F*(1, 542) = 0.79
Interval (linear)	125	544				*F*(1, 542) = 75.71***
Intercept			−0.11 (0.02)***	−0.14	−0.07	
Interval (linear)			−0.09 (0.01)***	−0.11	−0.07	
Interval (quadratic)	125	544				*F*(2, 541) = 39.99***
Intercept			−0.09 (0.02)***	−0.13	−0.06	
Interval			−0.07 (0.02)***	−0.11	−0.03	
Interval^2			−0.01 (0.01)	−0.02	0.00	

Abbreviations: *b**, standardised regression coefficient; df, degrees of freedom; *F*, Fisher's *F* ratio; *h*, number of coefficients in the meta-analysis; *k*, number of studies in the meta-analysis; lower CI, lower confidence interval; SE, standard error; upper CI, upper confidence interval.

Is change in student engagement moderated by adolescent gender?

Our mixed-effects meta-regression model (Table 3) found no impact of the percentage of girls versus boys in the study samples on change in engagement.

Is change in student engagement moderated by school transition?

Our mixed-effects meta-regression model (Table 3) examined the comparative impact of three categories of school transition: transition from primary to lower secondary education (i.e., elementary/primary school to middle/secondary school), transition from lower to upper secondary education (e.g., middle to high school), and no transition. Results show that, on average, for the group of students who did not experience a transition, engagement changed negatively over time. There were even greater negative changes in engagement when adolescents transferred from primary to lower secondary schooling (elementary to middle school) and from lower secondary to upper secondary schooling (middle to high school).

TABLE 3 Impact of construct, gender, grade and transition on change in engagement.

Moderator	*k*	*h*	Moderator effect *b**(SE)	Lower CI	Upper CI	*F*(df 1, df 2)
Constructs	125	544				$F(5, 538) = 0.47$
Behavioural	68	226	−0.11 (0.03)***	−0.17	−0.06	
Emotional	45	130	−0.12 (0.03)***	−0.18	−0.06	
Mixed	45	99	−0.08 (0.03)**	−0.13	−0.02	
Cognitive	25	68	−0.07 (0.03)*	−0.13	−0.01	
Other	3	16	−0.03 (0.11)	−0.21	0.23	
Agentic	3	5	−0.04 (0.10)	−0.31	0.23	
Gender (% girls)	116	525	0.20 (0.22)	−0.23	0.63	$F(1, 523) = 0.82$
Grade	124	543				$F(2, 540) = 44.72$***
Intercept			−0.35 (0.07)***	−0.49	−0.21	
Grade level			0.03 (0.01)***	0.02	0.07	
Interval			−0.11 (0.01)***	−0.15	−0.09	
Transition (upper/lower/none)	125	544				$F(2, 541) = 1.36$
No transition	96	392	−0.08 (0.02)***	−0.12	−0.04	
Primary to lower vs. none	10	74	−0.15 (0.05)**	−0.25	−0.05	
Lower to upper vs. none	20	78	−0.14 (0.06)*	−0.25	−0.03	

Abbreviations: *b**, standardised regression coefficient; df, degrees of freedom; *F*, Fisher's *F* ratio; *h*, number of coefficients in the meta-analysis; *k*, number of studies in the meta-analysis; lower CI, lower confidence interval; SE, standard error; upper CI, upper confidence interval.

Is change in student engagement moderated by school grade?

We used a mixed-effects meta-regression model (Table 3) to test the impact of school grade at first measurement point on engagement change, controlling for the interval between measurements. We found that grade at first measurement had a positive impact on change in engagement, meaning that the magnitude of decline was smaller when students were measured at higher grades. This signals that the decline in student engagement is steeper in early adolescence, compared to middle and late adolescence.

DISCUSSION

In this meta-analysis we synthesized change in student engagement occurring across adolescence, using evidence from a comprehensive search of the international literature. With systematic search techniques, we identified 125 studies suitable for analysis that contained 223 repeated measurements of engagement which allowed us to compute 544 effect sizes. Using multilevel meta-regression models, we tested whether change in engagement was impacted by study key characteristics, the measured engagement construct (e.g., behavioural, cognitive), school transition, school grade and student gender. We found a small, significant decline in student engagement across adolescence that was similar for emotional, cognitive, and behavioural engagement. The decline in engagement was more pronounced when samples were measured in Europe or the United States, when the engagement measure was taken with student self-report, and when the interval between measurements was longer. Change in engagement was also more negative when students

experienced a school transition, and when students were in early adolescence compared to later school grades. There was no impact of study publication year nor gender. Overall, these results document a negative change in student engagement in adolescence that is robust across the set of studies with varied study characteristics. We discuss the main findings below.

Change in student engagement

Our major finding is of a small, significant decline in student engagement across adolescence. This finding aligns with the assumptions of stage-environment fit theory (Eccles et al., 1993) that adolescents tend to lose interest and motivation in schooling as they age due to a mismatch between their developmental needs (e.g., for autonomy and competence) and the school environment. The Glass's Δ effect size of −0.09 is extremely small, indicating that the decline was extremely gentle on average. This result concurs with studies that use growth mixture modelling to uncover multiple trajectories of engagement development across adolescence. In Janosz et al. (2008), most students had a very gentle decrease in engagement (emotional, behavioural, and cognitive), whereas in Symonds et al. (2016) most students had moderate stable levels of emotional engagement. In both studies, there were much smaller subgroups of students who had either steeply increasing engagement or steeply decreasing engagement. Accordingly, our small effect size of −0.09 represents a trend that cannot be generalised to all students. More likely, each sample in the meta-analysis contains multiple trajectories of engagement development. Within these samples, there is the possibility for subgroups of students with gently declining or more steeply declining trajectories. In some cases, smaller subgroups of students with more steeply declining trajectories might be pulling down the mean levels across the remainder of the students.

The impact of geographic area

Another key finding was that geographic area moderated change in engagement. This result may relate to the larger number of studies in Europe ($N = 37$) and North America ($N = 53$) compared to 21 studies in Asia and 11 studies in the Antipodes, and only 3 studies in Africa and the Middle East. Therefore, the result may be a methodological artefact. Alternatively, it might relate to the characteristics of the education systems in those geographic areas. The countries within Europe were mainly Belgium ($N = 14$), Finland ($N = 17$), and Portugal ($N = 8$). All three countries have a two-tier education system (primary and secondary). In Belgium, adolescents move into general, arts-based, technical, or vocational education in early adolescence; whilst in Finland adolescents move into general or vocational education in mid-adolescence (European Commission, 2021). However, in Portugal, schooling is comprehensive with vocational and academic subjects mainly offered within the same secondary schools rather than within separate school tracks (European Commission, 2021). All the North American studies were from the USA. The USA's education system is mainly three-tiered (elementary, middle, and secondary) and comprehensive, with a range of ages within school tiers (for a mapping see Symonds et al., 2023). Engagement changes in Europe and North America were more negative compared to engagement changes in the Antipodes and Asia. Education in Australia (10 out of 11 Antipodes samples) is mainly comprehensive with no tracking, and two-tiered (primary and secondary). The Asian studies were mainly from China ($N = 7$), South Korea ($N = 7$), and the Philippines ($N = 4$). China, South Korea, and the Philippines have a three-tiered system (primary, middle, and secondary)

with academic and vocational tracking in secondary schooling. As evident from the above review of education systems, there is no systematic relationship between school tiers nor tracked/comprehensive designs and the study findings. Possibly, sociocultural differences between school environments, or broader sociocultural factors impacting how education is experienced, are responsible for the finding of geographic differences in engagement decline.

The impact of adolescent self-report

Next, we found that adolescent self-report of engagement was associated with more negative change in engagement. This finding could also be a methodological artefact, given that 195 measurements were self-reported, compared to other respondents (teacher $N = 17$, parent $N = 4$, peer $N = 3$, observer $N = 3$). However, the finding could also represent a real difference between how adolescents feel versus how their experiences are interpreted by external observers. The validity of adolescent self-reports has been tested for objective measurements e.g., achievement, weight, and height (Crockett et al., 1987) and for risky behaviours e.g., drug and alcohol use (Brener et al., 2003). The studies found that adolescents generally accurately report or slightly under-report those factors. In the school engagement literature, very few studies examine engagement using multiple respondents. Studies using teacher and student reports have, for example, found similar mean values between respondent groups that align with a relatively normal distribution of responses within the group (e.g., Rimm-Kaufman et al., 2015). In our dataset, there were no relationships between respondent group and grade at first measurement ($F = 0.772(4)$, $p = 0.545$), nor between respondent group and engagement construct ($\chi 2 = 16.09(20)$, $p = 0.711$), ruling out the possibility of confounding factors relating to student age/grade and the type of engagement studied.

The impact of age and grade

Across the studies, we found that changes in engagement were less pronounced when measured at older grades (b^* 0.03, $p < 0.001$), meaning that engagement declined more steeply during early adolescence. This finding fits well with the meta-analysis results of Scherrer and Preckel (2019), where the change in mastery motivation became smaller with rising grade level ($b = 0.5$, $p < 0.05$). It also aligns with descriptive research which documents that self-reported school experiences and self-perceptions become more negative from middle childhood to the end of early adolescence (Wigfield et al., 1991). Another perspective on the finding can be gleaned from research that used a UK national cohort study of 14 to 17-year-olds to investigate heterogenous trajectories of engagement (measured as interest in schoolwork) (Symonds et al., 2016). In that study, only a few adolescents had downward trajectories of engagement across the mid-adolescent period and most adolescents had stable, moderate levels of engagement. Our meta-analysis supports this general pattern, suggesting that decline in student engagement becomes less steep during mid-adolescence.

The impact of school transition

Finally, we found that student engagement changed more negatively in groups of adolescents who experienced a school transition. This finding contrasts with the meta-analysis of motivational variables by Scherrer and Preckel (2019) where no impact of school transition was found. In our

meta-analysis of student engagement, the magnitude of the change was higher for adolescents transferring from primary to lower secondary education (elementary to middle) ($b^* = -0.15$, $p < 0.001$) and from lower secondary to upper secondary education (middle to high) ($b^* = -0.14$, $p < 0.001$), compared to adolescents without a school transition. This finding aligns with stage-environment fit theory which predicts that environmental changes at school transition will typically mismatch with adolescents' developing psychological and social needs (Eccles et al., 1993). The premise of stage-environment fit theory is well developed for the transition from primary to lower secondary schooling, emphasising discontinuities between environments. Discontinuities include moving from smaller to larger schools and classrooms, from a single classroom teacher to multiple subject specialist teachers, and from a less pressured to more pressured academic environment (Symonds et al., 2023). However, stage-environment fit theory is rarely applied to the transition from lower secondary schooling to upper secondary schooling, where there are fewer discontinuities and more continuities (e.g., the school sizes can be more similar, and the focus on academic testing continues). Although many adolescents adjust well after school transition (Jindal Snape et al., Jindal-Snape et al., 2023), our results demonstrate that the act of changing schools still encourages a loss of engagement in adolescence.

Implications for research

Returning to the four proposed mechanisms of engagement change (Symonds & Hargreaves, 2016), our results support the notion that engagement declines as part of normative psychological development (found in the group with no transition) with the greatest declines in early adolescence. We also found that engagement declines in response to school transition (found in the two transition groups). Given our reliance on published data, our study was not able to unpack the extent to which engagement declines at school transition were attributable to changes in the school environment, changes in the person as they move schools, or to the interaction between school transition and normative declines in engagement. Further exploratory and hypothesis-driven research could help clarify these mechanisms. Qualitative research could map the factors that promote and inhibit engagement in adolescents who transfer schools at different ages and grades. Quantitative research could test whether adolescents become more disillusioned with schooling because of metacognitive changes at school transition. More nuanced investigations are needed to untangle the interactions between school transition and normative declines in student engagement in adolescence.

Implications for practice

Our meta-analysis identified an overarching decline in student engagement across adolescence, that was consistent across emotional, cognitive, behavioural, and other measurements of engagement. We were able to pinpoint small impacts of geographic area, adolescent self-report, adolescent age/grade, and school transition on this decline. Because we did not examine the decline in relation to educational environments or practices, or in relation to student psychological characteristics (e.g., self-efficacy), it is not feasible for us to make fine-grained recommendations for pedagogical approaches that could make schooling more engaging for adolescents. However, we can conclude that school transitions, especially in early adolescence, appear to speed up decreases in engagement. From an educational policy perspective, this has implications for two and three tier education systems where the number of transitions and the timing of transitions is modifiable. In some countries such as Finland, there is only one transition (to tracked education) and this occurs

in mid-adolescence. Possibly this later timing of transition is preferable because it avoids the convergence of multiple developmental transitions in early adolescence including first pubertal changes and the rapid development of personal identity that manifests in sudden and frequent changes in friendships and social groups (Jindal Snape et al., 2023; Symonds et al., 2014). Policy makers may wish to consider the historical and practical reasons behind their educational system's transitions and to review whether these are optimal or even potentially harmful for student engagement.

LIMITATIONS

Although this meta-analysis used rigorous systematic techniques to collect, extract, and analyse data, it is not without its limitations. First, nearly all studies in the meta-analysis relied exclusively on student self-report. Indeed, teacher and peer observations of engagement did not contribute to the rate of change in engagement documented across the studies, whereas student self-report did. Although individuals are the best to judge and express their own emotional experiences, it may be that their behaviours and cognitive engagement may differ from their self-perceptions, and their self-perceptions may in part reflect the perceptions of them held by their peer group. Accordingly, our main finding is that student self-reported engagement declines in adolescence: highlighting the need for more longitudinal studies of engagement measured using teacher, peer, parent, and observer perceptions.

Second, the evidence base included in this meta-analysis does not proceed past July 2022. Despite having a large study team, it took many months to collect and prepare the meta-analysis data, due to the time spent screening and coding, and to follow up of individual studies for missing data. With increasing numbers of student engagement studies published every year (Salmela-Aro et al., 2022), a follow-up meta-analysis is recommended, perhaps within a five- or ten-year interval. Related to the timeframe of our meta-analysis, some of the studies may have collected data across the COVID-19 pandemic. Future meta-analyses should attempt to identify any pandemic-related impact on trajectories of student engagement, by, for example, including the COVID-19 pandemic timeframe as a moderator variable.

Furthermore, our meta-analysis only included studies published in English. A retrospective search for studies in other languages that would fit the inclusion and exclusion criteria of this meta-analysis would be a worthwhile endeavour for ensuring cross-national validity of the results.

Finally, we did not include grey literature in the meta-analysis. This was to limit the database of statistics to evidence that had passed blinded peer review, to ensure that our summary of engagement trends and moderators was of the highest possible certainty. Future studies may wish to include the grey literature on the development of student engagement in adolescence and use grey literature as a moderating variable to test whether there is a difference between grey versus peer-reviewed evidence.

CONCLUSION

Our meta-analysis found an overall negative change in student engagement across adolescence that was independent of the type of engagement measured. We also found that school transition encourages negative change in engagement in early and mid-adolescence. Our findings also add to the literature by documenting more negative change in student engagement during early adolescence compared to middle and late adolescence, possibly resulting from a rapid developmental shift in perceptions that starts in middle childhood and eases off around mid-adolescence. Declines in engagement were consistent regardless

of gender but were more pronounced in European and North American samples and for adolescent self-report compared to reports by teachers, peers, parents, and observers. The major contribution of our study is that declines in student engagement appear to be normative internationally and are not related to differences in school tiers and school curriculum (as discussed in relation to geographic area). Although these results could signal that educators and curriculum designers can do little to stop adolescents from feeling more negative about school as they age, the major implication is that there is a general misfit between schooling and adolescent development.

AUTHOR CONTRIBUTIONS

Jennifer E. Symonds: Conceptualization; methodology; data curation; investigation; formal analysis; supervision; project administration; writing – original draft; writing – review and editing. **Jiesi Guo:** Methodology; formal analysis; data curation; visualization; writing – review and editing. **Xin Tang:** Conceptualization; methodology; data curation; investigation; formal analysis; writing – review and editing. **Katja Upadyaya:** Conceptualization; data curation; investigation; writing – review and editing. **Junlin Yu:** Conceptualization; investigation; writing – review and editing; data curation. **Natalie Vaccaro:** Data curation; investigation. **Daniel Guigui:** Data curation; investigation. **Sara Ponce:** Data curation; investigation. **Niall Costello:** Data curation; investigation. **Katariina Salmela-Aro:** Conceptualization; methodology; investigation; writing – review and editing.

CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to disclose.

DATA AVAILABILITY STATEMENT

The data for the meta-analysis will be made freely available on OSF after blinded peer review. The data are available as supplementary materials in the submission.

ETHICAL APPROVAL STATEMENT

The research did not undergo ethical review because it is a meta-analysis of freely available data.

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