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Explaining Disparities in Higher-Education Participation by Socio-Economic-Background: A Longitudinal Study of an Australian National Cohort

Ning Xiang [1,2,*], Francisco Perales [3] and Wojtek Tomaszewski [1,2]

[1] Institute for Social Science Research, The University of Queensland, Brisbane 4068, Australia; w.tomaszewski@uq.edu.au
[2] The Australian Research Council Centre of Excellence for Children and Families Over the Life Course (Life Course Centre), The University of Queensland, Brisbane 4068, Australia
[3] School of Government and International Relations, Griffith University, Brisbane 4111, Australia
* Correspondence: n.xiang@uq.edu.au; Tel.: +61-07-33469304

Abstract

Ensuring equitable access to higher education (HE) is not only a matter of social justice, but also a critical component to enhancing the long-term sustainability of modern societies. This study contributes to existing knowledge on socio-economic disparities in HE participation in Australia by identifying the extent to which key factors at the family, school, and individual levels mediate the relationship between socio-economic status (SES) and university enrolment. In doing so, it extends existing knowledge by simultaneously considering multiple factors at each ecological level, which enables us to disentangle their independent and joint influences on the SES differential in HE enrolment. To accomplish this, we analysed longitudinal data from the 2009 cohort of the Longitudinal Survey of Australian Youth (LSAY) using event-history models. Our findings reveal that students from lower-SES backgrounds are significantly less likely to enrol in university than their higher-SES peers, with persistent barriers emerging across multiple levels of influence. Indeed, after adjusting for cognitive skills, HE expectations, parental support, school climate, and access to learning resources, the estimated SES effect on HE participation was reduced by 68.6%. By systematically disentangling the relative contributions of these factors, this study provides critical insights into how sustainable education policies can be designed to mitigate social inequalities and promote inclusive growth. Intervention areas are discussed accordingly.

Keywords: widening university participation; socio-economic background; equity in higher education; sustainable education; Australia

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1. Introduction

Promoting access to and participation in higher education (HE) among socio-economically disadvantaged students has been a strong policy focus, both internationally [1] and in Australia [2] (NBEET, 1996). This dedicated focus has been driven by the well-documented benefits of attaining tertiary-level educational qualifications, both for individuals and the broader society [3]. Furthermore, investments in educational equity can drive long-term societal benefits. Specifically, ensuring that disadvantaged students have access to HE reduces social stratification, enhances workforce diversity, and fosters

economic resilience, all of which represent key components of the United Nations Sustainable Development Goals (SDGs) [4], particularly SDG 4 (Quality Education) and SDG 10 (Reduced Inequalities).

Concerted policy efforts to widen HE participation in most developed countries over the past decades, coupled with a considerable expansion of the HE sector [5], have increased the opportunities for people from low socio-economic status (SES) backgrounds to participate in HE. However, individuals from low-SES backgrounds still face significant barriers to accessing and completing university studies [6–8]. A growing body of literature has discussed various putative mechanisms contributing to these disparities, including differences in expectations and aspirations by SES [9,10], differences in material resources, such as household income and wealth [11], and group differences in social and cultural capital [12,13]. Recent studies also highlight the crucial role of school practices and students' school experiences in improving the academic performance of low-SES students [14,15]. Nevertheless, few studies have simultaneously tested the relative contributions of these factors to the disparity in HE participation amongst individuals from low- and high-SES backgrounds. For example, some studies such as Goldthorpe [10] and Huang et al. [11] have focused exclusively on individual or family factors, while others such as Tomaszewski et al. [14] have put the analytic onus on school-level factors. In addition, much of the current evidence is based on point-in-time (i.e., cross-sectional) studies, yielding limited insights into how these processes unfold over time.

In this paper, we draw on Bronfenbrenner's ecological systems theory [16] as the conceptual framework for understanding how multiple, interrelated factors at different levels of the social environment shape students' trajectories into higher education (HE). This theoretical lens is particularly well suited to our investigation, as it emphasises the interconnectedness of individual development and broader social systems, recognising that student outcomes are not solely the product of individual traits, but emerge from dynamic interactions between individuals and their surrounding contexts over time. We apply this framework to conceptualise how structural and relational factors at the family, school, and individual levels collectively contribute to the gap in HE participation between low- and high-SES students. Specifically, we consider family-level influences (e.g., parental education resources and HE expectations), school-level factors (e.g., school resourcing, disciplinary climate, and student experiences), and individual-level characteristics (e.g., cognitive skills captured through academic performance and personal HE aspirations).

Ecological systems theory therefore allows us to explore not only the independent contributions of these domains, but also their cumulative and potentially compounding effects, particularly for students from disadvantaged backgrounds. By adopting this theoretical approach, we aim to move beyond linear or isolated explanations of educational inequality. Instead, we examine how socio-economic status shapes access to, and experiences within, each ecological layer, and how these layers interact to either constrain or enable HE participation. This systems perspective is essential for identifying leverage points for intervention and policy reform, as it foregrounds the complex, multilayered realities that low-SES students navigate in their educational journeys.

To accomplish our research aims, we apply event-history, longitudinal regression to model panel data from a recent and nationally representative cohort of Australian young people (the 2009 cohort of the Longitudinal Surveys of Australian Youth, LSAY; n = 12,679).

1.1. Literature Review

The ecological systems approach to understanding human development is often depicted as a series of concentric circles representing different levels of influence, with the individual at the centre. These levels of influence typically include the microsystem (in-

dividual's immediate environment), mesosystem (interactions between microsystems), exosystem (settings indirectly influencing development), macrosystem (cultural and societal values), and chronosystem (historical changes over time) [16]. Human development can be conceptualised as the outcome of these multilevel influences and their cross-level interactions, including through mechanisms operating within the family, school and broad societal environments [16,17]. According to the ecological systems approach, the characteristics of the developing person "function both as an indirect producer and as a product of development" [16] (p. 798). In other words, individual characteristics, such as cognitive skills and HE expectations, are both the determinants of the person's future outcomes and the outcome of the interaction between the developing person and their immediate and remote environments.

This ecological model of human development provides a useful framework, which has been used to understand human development in multiple outcomes, such as cognitive, health or educational outcomes. Here, we deploy it as a useful organising framework to couch the multiple factors of influence that may constrain or improve equity in HE participation. Within this context, an ecological approach highlights the important role of various contextual factors in shaping educational development, as well as the interactional and shifting nature of the relationship between students and their environments [16]. For children and young people, we posit that their educational pathways are influenced most immediately by family, school and community [18]. Student outcomes at the individual level are the product of young people interacting with others and their environment in ways that may facilitate or constrain opportunities [19].

As the ecological system framework suggests, low-SES students may encounter constraining factors at the family, school and individual levels. First, as the theory depicts, at the centre of system is the active person, whose individual cognitive and non-cognitive development ostensibly shapes their participation in HE. For instance, previous academic/school performance and HE expectations are often characterised as key predictors of HE participation and success [20,21]. However, and perhaps more importantly, as the empirical evidence highlights, these individual factors are in and of themselves shaped by young people's family background [21,22] and school experiences [18,23].

In the next sections, we briefly review relevant literature on factors that may constrain low-SES students' HE participation at the family, school and individual levels. It is important to note that the bulk of this literature has focused on developed countries (e.g., the United States, United Kingdom, and Germany), with a sizeable number of contributions from the country in which the present study is based (Australia). While there may be some differences in findings for different factors and countries, the overall picture is one of consistency.

1.1.1. Family Factors

A substantial body of research within the field of social stratification has explored how family-level dynamics influence the relationship between socio-economic status (SES) and educational outcomes [24–26]. Traditional explanations often highlight the role of material resources, suggesting that access to assets such as household income and wealth significantly shapes students' academic trajectories [11,27]. Families with greater financial means can afford advantages such as enrolment in high-performing schools, private tutoring, and supportive home-learning environments, all of which tend to enhance educational performance [24]. Conversely, limited financial capacity in lower-SES households can restrict their ability to invest in resources that facilitate educational advancement, including pathways to higher education [25].

Beyond financial factors, parental expectations have also been shown to play an important role in shaping children's educational outcomes, including academic achievement [28,29] and aspirations for university study [30]. For example, a meta-analysis of 169 studies by Pinquart and Ebeling [28] found consistent small-to-moderate positive associations—both cross-sectional and longitudinal—between parental expectations and students' academic performance. In the Australian context, Gemici and colleagues [30] used data from over 14,000 participants in the 2009 Longitudinal Surveys of Australian Youth (LSAY) cohort and reported that students whose parents expected them to attend university were significantly more likely to express intentions to pursue higher education, compared to peers without such parental expectations.

1.1.2. School Factors

Students' school experiences also vary by SES. For instance, low-SES children tend to attend schools with greater shares of socio-economically disadvantaged peers. As a result, low-SES students are more likely to encounter classmates who have lower academic performance and higher drop-out rates, compared to higher-SES students attending schools where most students come from affluent families [18,31]. Consistent with this, Tomaszewski et al. [23] found that low-SES students tend to report a lower sense of belonging and school liking than their more advantaged peers. While there are many mechanisms through which schools may exert (positive or negative) influences on students' subsequent HE participation [32], this study focuses on three key indicators of school climate. These are: school resource availability, classroom disciplinary climate and students' experiences at school.

School climate is a well-established conceptual framework to guide the exploration of what happens within schools and how this affects children. 'School climate' can be broadly defined as the quality and character of school life, it is "*based on patterns of people's experiences of school life and reflects norms, goals, values, interpersonal relationships, teaching and learning practices, and organisational structures*" [33] (p. 180). Despite a lack of consensus among researchers on the specific dimensions of this construct, school climate is generally conceptualised as a multidimensional construct encompassing safety (e.g., disciplinary climate), academic climate (e.g., teaching practices), community (e.g., quality of relationships), and institutional environment (e.g., availability of resources). Given robust empirical evidence demonstrating the effects of positive school climate on a range of learning outcomes, including academic achievement and attainment [34–36], the promotion of a positive school climate has been a core education-policy focus within developed countries [37]. For instance, Quin [35] conducted a systematic review of 46 studies and concluded that students who reported better school experiences are more likely to perform better academically and are less likely to drop out of school. In addition, Berkowitz et al. [38] looked at the specific role of school climate in addressing the achievement gap between students from different SES backgrounds. Their systematic review of 78 articles published between 2000 and 2015 found positive effects of supportive school climate in mitigating disparities in academic achievement between low- and high-SES students.

It is pertinent to note that, consistent with tenets from the ecological systems framework, school-level factors are unlikely to operate in isolation from factors at other ecological levels. Rather, the influence of school-level factors may be intertwined in complex and interactive ways with that of individual- or family-level factors. For example, theoretically, being exposed to a better school climate may ameliorate or even suppress any negative effects on young people's HE enrolment stemming from individual-level factors (e.g., low literacy or academic performance) or family-level factors (e.g., a lack of family support or

HE aspirations). This point serves to reinforce the value of considering the role of multiple sets of factors on HE enrolment in a simultaneous rather than piecemeal fashion.

1.1.3. Individual Characteristics

As the ecological system framework suggests, individuals develop within a complex system of relationships and environments that impact their growth, behaviour and personal outcomes. Individual outcomes are thus the product of multiple interactions between individuals and their surrounding systems. However, as the model suggests, personal outcomes also depend on the characteristics of the individual—both innate characteristics and characteristics internalised from those multiple systems of influence. An important set of individual-level characteristics influencing young people's educational outcomes are cognitive and non-cognitive traits, which may shape students' ability and decisions to participate in HE [20,21]. Cognitive skills have also been identified as a major factor shaping the odds of HE participation, specifically [22], largely through previous academic performance. For instance, in Australia, poor school performance has been recognised as a major barrier to HE participation for low-SES students [39].

Another main individual-level factor is students' HE expectations [40,41]. Indeed, accumulating empirical evidence has underscored the significant role of students' educational expectations in predicting a range of educational outcomes, including educational attainment and HE participation [41,42]. For instance, Johnson and Reynolds [41] utilised longitudinal data from American high-school students to explore the relationship between educational expectations and educational attainment. Their findings revealed that high-SES students are more likely to hold onto their HE expectations over the years than their low-SES peers, which then translates into a greater propensity to access HE.

At this point, it is important to note that—despite being considered individual-level measures—young people's cognitive skills and educational aspirations/expectations (a) are not traits that individuals are born with, and (b) may be intertwined in complex ways with school- and family-level factors. For example, young people's ability at math—a proxy for cognitive ability used within this study—may be shaped by the quality of teaching at school, or the degree of parental support with assessment. Overall, as posited by ecological systems theory, relationships between factors sitting at different levels of the system are often complex and characterised by bidirectionality and reciprocity, rather than determinism and one-way causation.

1.2. The Present Study: Context, Aims and Contributions

The above section briefly reviewed a range of factors at the family, school and individual levels identified in the previous literature as key mechanisms through which individuals' family SES might affect their chances to access HE. Although each of these factors is supported by relevant theories and empirical evidence, the mechanisms have been usually investigated in isolation. Therefore, it remains unclear which factors might be more influential than others, or whether the influence of some factors disappears when other, correlated contributing factors are taken into account. Through the lens of the ecological system perspective [16,17], this study addresses this knowledge gap by simultaneously considering mechanisms from different ecological system levels, and disentangling their relative contributions. Placing multiple mechanisms within the same empirical framework may reveal comparative differences in the magnitude and strength of their influence on disparities in HE entry by SES. Importantly, by identifying modifiable factors that facilitate HE participation, our findings hold the potential to inform evidence-based policies that promote intergenerational social mobility, reduce educational wastage, and support sustainable human capital development.

Closest to our study are contributions such as [14]—which examined how equity-group membership influenced HE enrolment and the intervening role of school-provided career guidance employing LSIC data sets—and [23]—which investigated the mediating role of student engagement in the relationship between low SES and NAPLAN test scores utilising LSAC data sets. The current study expands on these contributions by simultaneously investigating how multiple intervening factors mediate the association between low SES and HE enrolment. In doing so, it considers intervening factors at several ecological levels (individual, family and school), and not just school guidance (as [14]) or student engagement (as [23]). It also uses a HE enrolment as the outcome of interest, rather than focusing on students' test scores (as performed in [23]).

As described in more detail below, our empirical analyses involve event-history analyses of panel data from a large cohort of Australian young people (LSAY). This analytic approach allows us to identify whether young people enrol in HE enrolment at any point from age 17 (when they become eligible) up to age 25. This approach has significant advantages over cross-sectional 'time-in-point- approaches, as students from low-SES backgrounds are more likely to delay university entry compared to their more advantaged peers. Capturing this extended timeframe ensures a more thorough comparison of HE participation across socio-economic groups.

Furthermore, we conduct our empirical analyses within an interesting contextual case study: Australia. Australia is widely recognised as a high-income country with a strong standard of living, underpinned by steady economic growth and high GDP per capita [43]. It also features relatively lower income inequality than other advanced economies, such as the United States [44]. Australian universities operate within a national publicly funded HE system, which has experienced several decades of steady expansion. Consistent with this, Australia's contemporary HE-participation rates are comparatively high for international standards [45]. Since 1990, successive Australian Governments have identified six equity groups as requiring assistance to improve their representation in HE, one which are students from low-SES backgrounds. However, despite significant investments and policy efforts towards achieving equity in HE, the enrolments of students from low-SES areas only grew from 16.1% in 2008 to 18.1% in 2020 [46], which underscores the severe entrenchment of inequalities by SES in the Australian HE sector [39].

2. Data and Methods

2.1. Data and Variables

2.1.1. The Longitudinal Surveys of Australian Youth

To accomplish our research aims, we leverage unique survey data from the Longitudinal Surveys of Australian Youth (LSAY), a series of large-scale, longitudinal cohort studies tracking young Australians from age 15 until they turn 25 years. The main aim of the LSAY surveys is to explore barriers to and facilitators of successful post-school transitions amongst Australian youth. To this end, LSAY collects annual data on topics such as education and training participation, employment and social development through a combination of online surveys and telephone interviews.

For the purposes of this research, we use the 2009 cohort of LSAY, for which data are integrated with the OECD Programme for International Student Assessment (PISA) records. The 2009 cohort sample was constructed by randomly selecting 50 students aged 15 years from each of the schools participating in the 2009 PISA exercise. This resulted in a probability sample of students aged 15 years old that was representative of all states and school sectors (Public, Independent and Catholic schools) within Australia. The sample being representative of states and sectors is an important step towards ensuring that the survey results can be confidently extrapolated to the Australian school system as a whole.

The key value of the LSAY data for this study lies in its rich information and longitudinal dimension. The study design allows us to identify multiple factors at the family, school and individual level throughout students' participation in secondary school that might affect their participation in HE. At the same time, the LSAY design also enables us to establish whether sampled young people eventually enrol in HE by the age of 25 (or before).

The initial sample size comprises 66,297 observations from 14,251 young people. After excluding those with missing data on the analytic variables (n = 1572), the resulting analytic sample size comprises 61,802 observations from 12,679 young people. Like other similar panel datasets of young people, LSAY exhibits relatively high attrition rates; for example, sample retention rates were 61.5% in wave 2, 53.5% in wave 3, 45.9% in wave 4, 40.6% in wave 5, and 20.6% in wave 11. To minimise the impact of attrition on the results, we follow earlier studies using these data to examine HE enrolment (see, e.g., [14]) and deploy event-history models. Details on this methodology are provided below. (We also ran robustness checks including weights provided by the survey team within the models. The results remained similar to those presented in the paper).

2.1.2. Outcome Variable: University Enrolment

Access to HE—the outcome of interest—is operationalised as a binary variable taking the value 1 when a young person first enrols into university, if such event occurred over the observation window, and the value 0 otherwise. Of those individuals who remained in the sample by wave 11 (n = 2765), 2157 (or 78%) had commenced HE study, whereas the rest (n = 608, or 22%) were never observed to do so (see Table 1).

Table 1. Sample descriptive statistics.

Variable	Mean/ Percentage	SD	Min	Max	Obs.
Outcome variable (by wave 11)					
Student enrolled at University	78%	-	0	1	2765
Explanatory variables (Wave 1)					12,679
Focal measure					
Low SES group	24%	-	0	1	
Family factors					
Family ICT resources	0.47	0.77	−2.53	1.30	
Parental HE expectation	39%		0	1	
School factors					
School ICT resources	0.01	0.99	−4.73	1.54	
Classroom disciplinary climate	−0.10	1.01	−2.81	1.84	
School experiences	2.81	0.43	1.00	4.00	
Individual factors					
PISA math score	516.00	86.49	151.20	795.85	
Individual HE expectation	33%		0	1	
Controls					
Boy	48%		0	1	
Indigenous	7%		0	1	
Regional/remote	29%		0	1	
Immigrant	20%		0	1	

Note: LSAY 2009. While all intervening factors are expressed as raw scores in this table, they were standardised before being included in subsequent multivariable analyses.

2.1.3. Key Explanatory Variable: Low SES

Our key explanatory variable is low SES. To operationalise this concept, we use a pre-existing survey indicator from LSAY Wave 1: the PISA index of Economic, Social and Cultural Status (ESCS). The ESCS is constructed by combining the following information:

the International Socio-Economic Index of Occupational Status (ISEI) of the student's parents; the highest level of education of the student's parents; the PISA index of family wealth; the PISA index of home educational resources; and the PISA index of possessions related to classical culture in the family home (for details, see [47], p. 136ff). Young people whose families were in the lowest quartile of the ESCS distribution were considered to be of low SES (value 1), while all other young people were considered to be of higher SES (value 0). Several reasons underpin our decision to dichotomize this SES variable, including following the OECD-recommended approach [44]; making our low-SES results more comparable to those presented earlier studies [14,23]; and enhancing our ability to compare results with other binary equity groups contained within our models (Indigenous young people, immigrant young people; and young people from regional/remote areas).

Using this definition, 3033 young people in our analytic sample (or 24%) are of a low SES (Table 1).

2.1.4. Intervening Variables

Consistent with the ecological model of human development introduced above [16], we consider a range of factors that may affect HE participation across the family, school and individual levels. The variables capturing these constructs are introduced as intervening variables in the multivariable regression models. We discuss the operationalization of each of these variables in turn. Descriptive statistics for all analytic variables are presented in Table 1.

Family-level factors include indicators of information, computer and technology (ICT) resources available at home and parental educational expectations. Family ICT resources are captured through a PISA index variable derived from eight items asking about availability of ICT devices at home (e.g., desktop computer, educational software, and internet connection). Higher values denote higher access to ICT resources at home. In our sample, the family ICT resources index ranges from −2.53 to 1.3, with a mean of 0.47 and a standard deviation of 0.77. Parental educational expectations are measured by asking participants whether their parents wanted them to attend university in the year immediately after leaving school. In our sample, 39% of participants believed that their parents wanted them to do so (Table 1).

School-level factors are approximated through three variables, namely ICT resources at school, students' perception of classroom disciplinary climate, and students' experiences at school. ICT availability at school is captured through a PISA scale variable derived from five items asking about the availability of ICT devices at school (e.g., desktop computer, printer and internet connection). Higher values denote higher resource availability. Disciplinary climate is a PISA index variable derived from five items asking about students' evaluation of their classes, such as "students don't listen to what the teacher says" (reverse coded); and "students don't start working for a long time after the lesson begins" (reverse coded). Higher values indicate a better disciplinary climate. School experiences come from the "Life at school" index variable capturing students' evaluation of their life at school. The index combines answers to 30 questions on students' school belonging, relationships with teachers, and enjoyment of learning. Higher values in this index indicate more positive school experiences.

Individual-level factors are approximated through variables capturing students' cognitive skills and expectations for HE. Cognitive skills are captured by PISA scores in mathematics. Empirical evidence indicates that PISA math scores are highly correlated with IQ [48], as such they serve as a good proxy for cognitive skills. In our sample, the PISA scores in mathematics range from 151.20 to 795.85, with a mean of 516 and a standard deviation of 86.49. Expectations for HE are measured through a question asking students

whether they had plans to go to university (after leaving school or in the future). In our sample, 33% of participants indicated that they planned to go to university at age of 15 (Table 1).

2.2. Methods

2.2.1. Low SES and Intervening Factors

We begin by estimating the associations between young people's SES and the intervening factors through a set of cross-sectional linear regression models. These models rely on data from Wave 1 of LSAY and take the following form:

$$IF = SEB_i\beta_1 + X_i\beta_2 + e_i \quad (1)$$

where subscript i denotes individuals; *IF* is a variable measuring a given intervening factor measured in LSAY Wave 1 (e.g., PISA test scores); SES is a binary indicator for low SES measured in LSAY Wave 1; the βs are (vectors of) model coefficients to be estimated; and e is the usual random error in regression. All models are adjusted for a set of binary control variables (X; 1 = Yes/0 = No) measured in LSAY Wave 1 and denoting whether or not the young people are female, Indigenous, from an immigration background, and from a regional/remote area of Australia.

2.2.2. Low SES and Enrolment in HE: Raw Effects

We continue by describing the average trajectories into university enrolment for young people from low- and higher-SES backgrounds through Kaplan–Meier hazard functions [49]. These give the unconditional hazard rate of HE enrolment at each wave of the survey; or—in other words—the proportion of young people who enrol in HE out of the total pool of young people who are 'at risk' of enrolling. If a young person eventually enrols in HE (or leaves the panel), the individual also leaves the pool of individuals who are at 'risk' of enrolling and no longer contributes to estimation [14].

We then estimate Cox regression models [50] that allow us to model the factors predicting the likelihood of young people enrolling into HE using a multivariable framework. Cox regression models are semi-parametric regression techniques of the event-history family that are useful to determine how different factors influence the occurrence of an event [45]. In this application, event-history models have two advantageous properties over traditional cross-sectional regression models: (i) they account for the fact that young people from low SES backgrounds may exhibit delayed enrolments into HE; and (ii) they help to handle sample attrition by considering only observations from individuals who remain 'at risk' of enrolling [14]. The model takes the following form:

$$h_i(t) = h_o(t) * exp(SEB_i\beta_1 + X_i\beta_2) \quad (2)$$

where subscript t denotes time; $h_0(t)$ is the baseline hazard function of HE enrolment; and all other terms are defined as per Equation (1) above. The coefficients from these models are expressed as hazard ratios (HRs), which give the expected change in the ratio of the odds of experiencing the 'hazard' (i.e., HE enrolment) associated with a one-unit increase in the explanatory variables.

2.2.3. Low SES and Enrolment in HE: Assessing the Role of Intervening Factors

To examine the intervening role of key factors at the individual, family and school levels on the relationship between low SES and enrolment in HE, we expand the initial Cox model presented in the previous section. Specifically, we fit a series of models in which we progressively add school-level factors (S, Equation (3)), family-level factors (F, Equation

(4)),) and individual-level factors (*I*, Equation (5)). A final model, depicted in Equation (6), introduces all factors at the same time.

$$h_i(t) = h_o(t) * exp(SES_i\beta_1 + X_i\beta_2 + S_i\beta_3) \quad (3)$$

$$h_i(t) = h_o(t) * exp(SES_i\beta_1 + X_i\beta_2 + F\beta_3) \quad (4)$$

$$h_i(t) = h_o(t) * exp(SES_i\beta_1 + X_i\beta_2 + I\beta_3) \quad (5)$$

$$h_i(t) = h_o(t) * exp(SES_i\beta_1 + X_i\beta_2 + F_i\beta_3 + S_i\beta_4 + I_i\beta_5) \quad (6)$$

We interpret any reductions in the SES coefficient between the initial and new models as evidence that the newly introduced variables act as intervening factors in the 'SES → HE participation' relationship. To quantify the effects, we calculate the percentage reduction in the low-SES coefficient.

3. Results

In this section, we present the results of our empirical analyses. The section is divided into three distinct parts. First, we present the results of regression models aimed at establishing the associations between low SES and the intervening factors. These analyses help determine that the theoretical factors informed by ecological system theory are associated with low SES in the expected ways in the LSAY data. Second, we report the results of Kaplan–Meier estimates, which help us depict the focal longitudinal patterns of enrolment in HE by low- and high-SES students. Finally, we discuss the results of regression models assessing the extent to which the intervening factors can explain disparities by SES in HE enrolment—the ultimate aim of our study.

3.1. Associations Between Low SES and Intervening Factors

Table 2 presents estimates on the associations between low SES (i.e., being in the bottom quarter of the ESCS index) and the seven intervening factors at the family, school and individual levels. As predicted, in comparison to their peers from higher-SES backgrounds, low-SES individuals reported significantly lower levels of family ICT resources ($\beta = -0.78$, $p < 0.001$), parental HE expectations ($\beta = -0.36$, $p < 0.001$), school ICT resources ($\beta = -0.20$, $p < 0.001$), classroom disciplinary climate ($\beta = -0.24$, $p < 0.001$), school experiences ($\beta = -0.28$, $p < 0.001$), PISA math scores ($\beta = -0.62$, $p < 0.001$), and individual HE expectations ($\beta = -0.31$, $p < 0.001$). These results confirm that, all else being equal, low-SES students in the LSAY sample possess fewer resources that are typically facilitative of HE participation.

Table 2. Associations between low SES and intervening variables.

	School Factors			**Family Factors**		**Individual Factors**	
	School ICT Resources	**Classroom Disciplinary Climate**	**School Experiences**	**Family ICT Resources**	**Parental HE Expectations**	**PISA Math**	**Individual HE Expectations**
	β	*β*	*β*	*β*	*β*	*β*	*β*
Low SES	−0.20 ***	−0.24 ***	−0.28 ***	−0.78 ***	−0.36 ***	−0.62 ***	−0.31 ***
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
n	12,679	12,679	12,679	12,679	12,679	12,679	12,679
R^2	0.0110	0.0321	0.0249	0.1560	0.0657	0.1230	0.0535

Notes: LSAY 2009, wave 1. Linear regression models. Statistical significance: *** $p < 0.001$. All models are adjusted for gender, Indigenous status, area type and immigration background.

3.2. Kaplan–Meier Estimates for Enrolment into HE

Figure 1 presents the failure function derived from Kaplan–Meier estimates, which depicts the probability of HE participation for participants from low-SES and higher-SES backgrounds over time. As the graph shows, few youths begin HE studies when they were 17 years old (wave 3), with a higher probability of this occurring amongst higher-SES (8.3%) compared to low-SES (4.1%) young people. At age 18, steep increases in the failure function indicate a higher probability of HE enrolment at this time point. While this increase takes place for both groups, it is substantially more marked for higher-SES young people (42.8%) than low-SES young people (22.3%). By wave 5, the gap between the two groups becomes even larger (57% vs. 29%) and then remains fairly constant up to the end of the observation period. Indeed, by wave 11, when the participants are around 25 years old, 67.3% of higher-SES and 41.1% of low-SES participants were observed to have enrolled into HE.

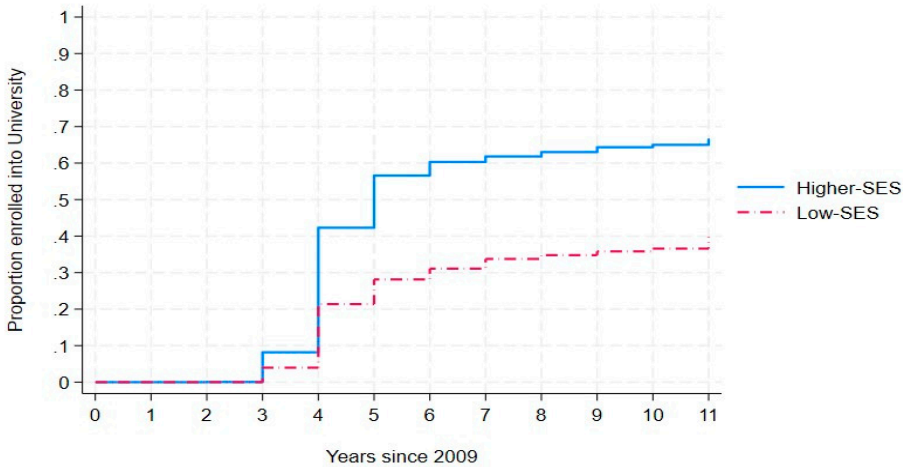


Figure 1. Kaplan–Meier estimates for enrolment into HE, by SES. (LSAY 2009, waves 1–11).

3.3. Role of the Intervening Factors on SES Disparities in HE Participation

Table 3 reports on the contribution of each of the intervening factors under consideration in explaining the disparity in HE participation between low- and higher-SES youth. In the base model including only the SES explanatory variable and the controls, the HR of HE enrolment for low-SES participants is 0.47 times ($p < 0.001$) that of their higher-SES counterparts.

Model 2 adds to Model 1 the intervening factors at the school level. Their inclusion moves the HR on the low-SES explanatory variable from 0.47 ($p < 0.001$) to 0.52 ($p < 0.001$), thus reducing its expected effect by 13.6% ($p > 0.05$). As predicted, higher levels of school ICT resources (HR = 1.04, $p < 0.05$), better classroom disciplinary climate (HR = 1.18, $p < 0.001$) and positive school experiences (HR = 1.36, $p < 0.001$) are all significantly associated with a higher likelihood of subsequent HE participation.

Model 3 adds to Model 1 the family-level intervening factors, which moves the HR on the low-SES explanatory variable from 0.47 ($p < 0.001$) to 0.61 ($p < 0.001$) and thus reduces the effect of low SES by 32.3% ($p < 0.005$). Consistent with theoretical expectations, higher levels of family ICT resources (HR = 1.22, $p < 0.001$) and parental expectations for young people to attend university (HR = 1.46, $p < 0.001$) are both significantly associated with a higher likelihood of subsequent HE participation.

Model 4 adds to Model 1 the individual-level intervening factors. Doing so moves the HR on the low-SES explanatory variable from 0.47 ($p < 0.001$) to 0.73 ($p < 0.001$). This is equivalent to a 58.1% reduction in the estimated effect of low-SES ($p < 0.001$). As expected, higher PISA math scores (HR = 2.15, $p < 0.001$) and having plans to attend

HE (HR = 1.31, $p < 0.001$) are both significantly associated with a higher likelihood of subsequent HE participation.

Table 3. Event-history models of HE participation.

	Model 1	Model 2	Model 3	Model 4	Model 5
	Base Model	**School Factors**	**Family Factors**	**Individual Factors**	**Full Model**
	HR	**HR**	**HR**	**HR**	**HR**
Low SES	0.47 ***	0.52 ***	0.61 ***	0.73 ***	0.80 ***
School factors					
School ICT resources		1.04 *			1.03
Classroom disciplinary climate		1.18 ***			1.07 ***
School experiences		1.36 ***			1.17 ***
Family factors					
Family ICT resources			1.22 ***		1.07 ***
Parental HE expectation			1.46 ***		1.17 ***
Individual factors					
PISA math				2.15 ***	2.00 ***
Individual HE expectation				1.31 ***	1.17 ***
Controls	Yes	Yes	Yes	Yes	Yes
Percentage decrease in SES effect	-	13.6%	32.3% **	58.1% ***	68.6% ***
n (observations)	51,102	51,102	51,102	51,102	51,102
n (individuals)	12,679	12,679	12,679	12,679	12,679

Notes: LSAY 2009, waves 1 to 11. Cox regression models; results presented as hazard ratios (HR). Statistical significance: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. All models are adjusted for gender, Indigenous status, area type and immigration background.

Finally, Model 5 includes all of the intervening factors simultaneously. In this model, we observed the most pronounced reduction in the low-SES HR (amounting to 68.6%, $p < 0.001$), which moves from 0.47 ($p < 0.001$) to 0.80 ($p < 0.001$). In this fully specified model, the estimated effects on all of the intervening factors remains statistically significant ($p < 0.001$), except for school ICT resources, which becomes non-significant (HR = 1.03, $p > 0.05$).

4. Discussion

4.1. Study Aims

Guided by ecological systems theory [16] and building on prior research into the drivers of higher education (HE) enrolment, this study has systematically explored how various factors at the family, school, and individual levels contribute to SES-based disparities in HE participation within the Australian context. Specifically, the analyses considered family-level variables (such as access to ICT resources and parental expectations for HE), school-level factors (including school ICT resources, disciplinary climate, and student experiences), and individual attributes (cognitive ability and personal HE expectations). We assessed the associations between low-SES background and each of these intervening variables, examined their independent contributions to HE participation, and evaluated their relative importance in either enabling or constraining access to higher education for low-SES students. The analysis drew on event-history regression models applied to panel

data from the 2009 cohort of the LSAY, a recent and nationally representative sample of Australian students.

4.2. Discussion of Key Findings and Contributions

As anticipated, the findings indicate that low-SES youth are more likely than their higher-SES peers to encounter conditions that hinder access to HE. These disadvantages are evident across family and school domains, including reduced access to family and school ICT resources, lower parental expectations for HE, and more negative classroom disciplinary climates and school experiences. Low-SES students also experienced disadvantages at the individual level: they achieved lower PISA mathematics scores and were less likely to expect to attend university.

Consistent with prior evidence, Kaplan–Meier estimates revealed a clear and widening gap in HE participation between low- and higher-SES groups over the eight years following school completion. Event-history analyses further demonstrated that this gap is shaped by multiple intervening factors, each exerting an independent influence on both HE participation and the SES-related disparity.

Notably, the set of family, school, and individual-level factors examined in this study collectively explained more than two-thirds of the SES effect on HE enrolment. School-level variables reduced the SES effect by 13.6%, while family-level factors—particularly parental HE expectations and household ICT resources—accounted for 32.3% of the gap. Individual-level factors, including students' academic achievement and their expectations for HE, had the largest explanatory power, reducing the SES effect by 58.1%.

This strong contribution from individual-level factors suggests that family and school influences partly operate through their impact on students' academic performance and aspirations. For instance, a parent's low expectations for their child's education could undermine the child's own motivation or belief in the value of HE, thereby reducing their likelihood of university enrolment. While such relationships are complex and likely bidirectional, the findings support the interpretation that individual-level factors lie further downstream in the causal pathway to HE and may mediate some of the influence of broader contextual factors.

Our findings contribute to existing literature on the effects of SES on HE participation in multiple ways. First, this study offers a better understanding of the intervening factors that can ameliorate the disparities in HE participation between low- and higher-SES students. In particular, by systematically investigating a range of factors at the family, school and individual levels, we were able to disentangle their separate contributions.

Second, our results complement previous research on early intervention focusing on the early years of a child's life [51,52]. While early intervention is undoubtedly important, our findings point to malleable factors that develop or intensify during adolescence, including school resources and the development of HE aspirations. The findings thus paint an optimistic picture on the value of later-in-life intervention. They suggest that investments aimed at 'levelling the field' during the high-school years can still reduce disparities in HE enrolment between low- and high-SES young people, even if these students enter high-school with different resources and degrees of advantage.

Third, our findings bear important implications for educational policy and practice. They do so by offering insights into potential factors to be targeted by interventions aimed at improving the chances of HE enrolment amongst low-SES students. For example, our results highlight the importance of school interventions that consider the classroom's disciplinary climate and students' school experiences. A recent OECD report on Australian education policy [53] points out that the disciplinary climate in schools in Australia was amongst the least favourable in the OECD. Our findings support the reports' subsequent

call for policies aimed at developing positive learning environments for students and teachers in Australia.

4.3. Study Limitations and Avenues for Future Research

While our findings contribute to expanding the literature on HE participation, some study limitations should be acknowledged. These limitations in turn suggest avenues for future research. First, due to constraints imposed by the available survey data, we only examined a limited number of factors within each level of the ecological system. Future research could expand our analyses by incorporating additional potential intervening factors across the various ecological levels, thereby providing a more comprehensive picture. At the individual level, additional factors may include young people's socio-emotional wellbeing, literacy levels, self-efficacy, persistence, and academic self-perception. At the family level, they may include social capital, number of siblings, parenting style, positive childhood experiences, and financial status. And at the school level, they might encompass other aspects of schools and their climate, including school funding, peer influences, school safety, teacher-student relationships, and community involvement.

Second, despite their richness, the LSAY data are subject to a substantial degree of attrition, as is the case for most longitudinal cohort studies of youth. In fact, as could be theoretically expected and observed in other longitudinal surveys, low-SES young people in the LSAY data set exhibited a higher likelihood to drop out of the survey prior to age 25 than their high-SES peers (88% compared to 76%). While our event-history models partially mitigate issues stemming from panel attrition, it is important to acknowledge that high attrition may limit the representativeness of later waves and introduce bias into the estimated associations. Caution should therefore be taken in interpreting the reported results, especially in relation to long-term trends or outcomes. This sort of attrition could also affect the broader generalisability of our findings. As such, future studies using cohort studies featuring greater follow-up rates—particularly amongst low-SES young people—would be valuable to further our understanding in this area.

Finally, while our findings underscore the role of school climate, statistical analyses of this nature are not inherently designed to provide detailed directions for the design of pedagogical interventions. Therefore, our study could be complemented by further research—perhaps based on qualitative methods—aimed at gaining deeper insights into the underlying mechanisms and processes implicated. This would enable the development of more effective evidence-based policies to promote equity within the Australian Higher Education system.

5. Conclusions

This research directly aligns with social sustainability by addressing inequalities in education—one of the most fundamental barriers to socio-economic progress and sustainable workforce development. A well-educated society fosters innovation, economic productivity, and civic engagement, reducing long-term reliance on social-welfare systems and contributing to a more sustainable and equitable future. Furthermore, more equitable HE participation promotes intergenerational social mobility, reduces educational wastage, and supports sustainable human-capital development.

To this end, our analyses unveiled multiple factors that jointly contribute to the underrepresentation of low-SES young people in HE. Leveraging ecological systems theory, we were able to demonstrate that the relevant contributing factors are not just located within the individual level, but rather extend to broader levels of interconnected influence—including the family and school levels. These contributing factors reduced SES disparities most markedly when measured at the individual level, followed by family factors, and

then school-level factors—reflecting the conceptual framework of concentric circles, where influences closest to the individual may exert the most direct impact on personal outcomes. Importantly, our findings suggest that addressing SES disparities in just the six factors considered in our analyses would reduce the underrepresentation of low-SES youth in HE by an impressive two thirds. Therefore, our findings can inform policies aiming to address equity in HE accesses by pointing to concrete intervention domains.

More broadly, our study adds to recent calls for a paradigm shift in HE policy, encouraging it to move beyond the mere provision of financial assistance to a more holistic set of interconnected interventions that address the varied social, psychological, and structural barriers hampering low-SES students' educational trajectories.

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Data Availability Statement: LSAY unit record (including linked data) files are deposited with the Australian Data Archive (ADA) at the Australian National University. Access to the data is free via a formal request and registration process managed by the ADA.

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