

Article

Student-Driven Instruction, Agency, and Curiosity: Mediation Evidence from 46,084 Subjects Across Multiple Sites

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Abstract

Curiosity is viewed as an essential element playing a key role in the learning process, driving learners to proactively identify and bridge knowledge gaps. However, the interaction between instructional strategies and psychological factors in nurturing curiosity is not well-understood. This study sought to explore connections between student-driven instruction and curiosity, with particular focus on the role of agency. This research employed structural equation modeling (SEM) using the Survey of Social and Emotional Skills (SSES), encompassing 46,084 student records. Results show that student-driven instruction is a positive predictor of both agency ($\beta = 0.094, p < 0.001$) and curiosity ($\beta = 0.043, p < 0.001$). Additionally, a strong positive correlation was observed between agency and curiosity ($\beta = 0.78, p < 0.001$). The mediation analysis identified student agency as a significant mediator, influencing the relationship between student-driven instruction and curiosity ($\beta = 0.073, p < 0.001$). Findings uncover valuable insights into instructional practices that prioritize student agency, contributing to the understanding of inter-and intra-personal factors influencing curiosity development.

Keywords: student-driven instruction; student agency; student curiosity; survey of social and emotional skills; structural equation modeling



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1. Introduction

Research in education has witnessed a significant increase in scholarly attention on student curiosity, emphasizing its critical influence on learners' personal and academic trajectories (J. J. Jirout et al., 2024; Wilson, 2024). Although a broad consensus concur that student curiosity matters, it has been challenging to describe due to its complex, elusive, and multi-layered nature (Berlyne, 1978; Evans et al., 2023). For decades, the concept of student curiosity has been a subject of various theoretical formulations. In this regard, some educational psychologists view curiosity as an individual's intrinsic interest and tendency for exploration and discovery (Litman, 2005; Silvia & Kashdan, 2009; Von Stumm et al., 2011), while others view it as a fundamental component that occupies a central role in the pedagogical process, driving individuals to seek new information and facilitating mitigation of knowledge deficits (Gruber & Ranganath, 2019; Phillips et al., 2018). Further, some scholars proposed a dualistic perspective on curiosity, distinguishing between curiosity as a state, wherein learners are temporarily motivated to pursue knowledge to address immediate informational voids through exploratory behaviors, and curiosity as a trait, which is characterized by a stable and pervasive inclination toward exploration and inquiry

across varied contexts (Evans et al., 2023). Building upon these theoretical perspectives, more recent frameworks integrate curiosity as a sub-dimension of openness to experience, characterized by individuals' propensity for embracing novel experiences and actively engage in exploratory and comprehension-driven activities (OECD, 2024; Soto et al., 2022; Von Stumm & Ackerman, 2013).

The established interdependence between student curiosity and both personal and academic development highlights the critical need to effectively operationalize its nurturing. Recent evidence suggests that it is often characterized by active engagement rather than passive reception, with students assuming a more proactive role in the seeking of knowledge as opposed to traditionally ascribed to them (Low & Van Ryzin, 2023; Reiser et al., 2021; Talbert et al., 2019). This approach closely aligns with the principles of student-driven instruction, which is rounded in constructivist theory of learning (Martinetti, 2020). From a pedagogical paradigm, knowledge is conceived as being "gained through the result of human reconstruction, both individually and through social interactions based on experiential learning" (Candra & Retnawati, 2020).

To date, it has been widely acknowledged that student-driven instruction transcends limitations of traditional teacher-centered instruction, and that it prioritizes student autonomy, choice, and decision-making, allowing learners to create their own understanding and to shape their learning trajectory (Herranen et al., 2018; Hodges, 2020). In this sense, student agency, often used interchangeably with concepts of freedom and autonomy granted to students, emerges as a critical outcome of student-driven instructional practices, reflecting the idea of students' desire to take innate control over their own learning (Reeve et al., 2004). An expansive corpus of evidence conceptualizes agency as the ability to take responsibility for one's learning, highlighting its influence on students assume key roles in leading their own learning, rather than confining themselves merely to the material being presented (Cherbow & McNeill, 2022; Jääskelä et al., 2020).

With the growing emphasis on student-initiated classrooms, autonomous learning styles have become a key focus in promoting sustainable learning and teaching practices (Liu et al., 2024b). Studies have demonstrated that pedagogical styles with minimal didactic intervention are posited to optimize learners' agency (Low & Van Ryzin, 2023; Murphy et al., 2021). In fact, enabling students to partake in heightened levels of agentic involvement through active participation in planning, monitoring, and reflective dimensions of the learning process was found to be influential in nurturing their cognitive and personal development (Liu et al., 2024a; Zivic et al., 2018). In this regard, teachers' intentional transference of learning control to students was also found to encourage them to participate in exploratory dialog in a supportive climate (Blinkoff et al., 2023; Mameli et al., 2020). As informed by self-determination theory, student agency is posited as a mediating variable between the pedagogical strategies employed by educators and a variety of educational outcomes (Jeno, 2015; Ryan & Deci, 2017). Recent investigations underscore the key role of student-centric pedagogical approaches that prioritize student choice, emphasizing that, when students are endowed with agency, they become knowledge generators who can build strong identities and engage in meaningful exploration (Blinkoff et al., 2023).

Critically, fostering student agency has been shown to positively empower students to assume leading roles as collaborative partners, which, in turn, helps cultivate a sense of curiosity among learners (Huttunen et al., 2024). An extensive body of research has demonstrated that an individual's sense of curiosity and exploratory drive are improved when their essential needs for autonomy, competence, and relatedness are met (Deci & Ryan, 2000; Ryan & Deci, 2017). More importantly, Brooks and Brooks (1999) suggested that, as learners, "we are all responsible for our own learning", highlighting that autonomous students are more inclined to seek out and assimilate new information, leading

to greater knowledge acquisition through discovery and fostering deeper cognitive integration during inquisitive learning experiences. In this light, the academic consensus supports the link between the natural need for control and the learners exploration, underscoring the importance of addressing these needs as a potent driver for enhancing curiosity (Grossnickle, 2016; J. Jirout & Klahr, 2012; Kidd & Hayden, 2015). Recent investigations into student well-being and emotions have indicated that activation of the dopamine system is correlated with both curiosity and exploration, as well as with student agency and decision-making power (Metcalf et al., 2021). Connection between student curiosity and levels of self-determination, choice, and knowledge construction arises when teachers provide an interactive learning environment that prioritizes the interest and excitement of students over merely meeting school requirements (Bierman & Sanders, 2021; Feraco & Meneghetti, 2023). Prior studies demonstrate that, when individuals are autonomously motivated, they show greater interest, excitement, and curiosity (Ryan & Deci, 2017). To this end, Fredrickson and Joiner (2018) also highlighted that, when the cycle of curiosity-driven exploration is coupled with feelings of autonomy and freedom of decision-making supported by teachers, it can encourage individuals to cultivate valuable self-development. On the basis of this concept, when students are reasonably autonomous in initiating actions central to their educational pursuits, they are more likely to engage in exploration, inquiry, and investigative processes that contribute to filling knowledge gaps (Peterson & Hidi, 2019).

Yet, despite the recognized positive relationship between implementation of student-driven instruction and curiosity, in addition to the identification of student-driven instruction as a predictor of agency, to the best of our knowledge, no prior studies have systematically investigated the link between student-driven instruction and student curiosity mediated by student agency, in conjunction. Gaps in the literature underscore the need for further investigation. The present study aims to empirically examine the direct effects between student-driven instruction and student agency (path a1), student agency and student curiosity (path a2), and student-driven instruction and student curiosity (path a3). Additionally, the current study is designed to examine the indirect effect of student-driven instruction on student curiosity through the mediating role of student agency (path b1), as presented in Figure 1. Consequently, the research is guided by the following research questions:

RQ1: What is the relationship between student-driven instruction and curiosity?

RQ2: To what extent does student agency mediate the relationship between student-driven instruction and curiosity?

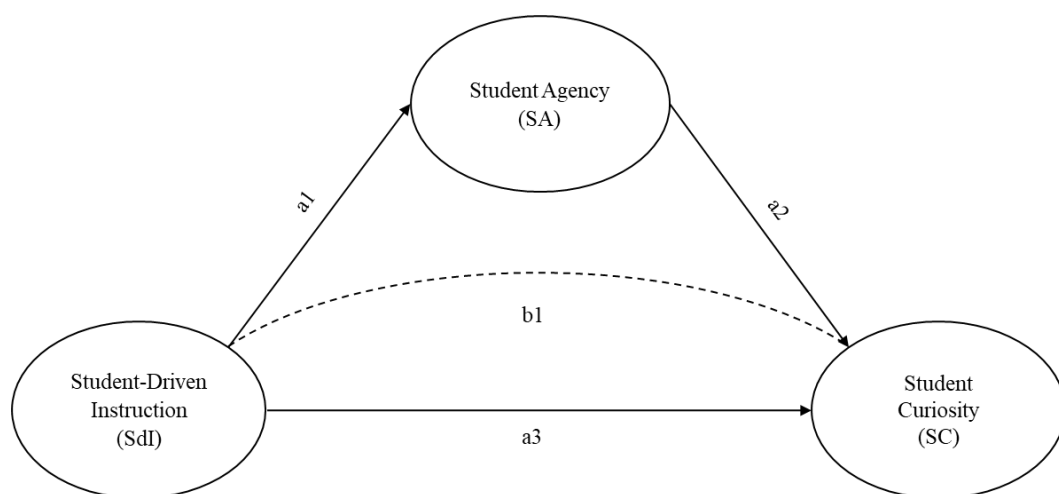


Figure 1. Conceptual framework of the study.

2. Method

Sample and context

This study leveraged data collected through a large-scale program Survey of Social and Emotional Skills (SSES) (OECD, 2021b). The SSES collects important sociodemographic information, as well as information on parents' education levels and socioeconomic status (OECD, 2021a). In terms of inclusion criteria for the analysis of this study, subject selection is defined as follows: (1) participated in the first wave of the SSES; (2) matched with the teacher or school students; and (3) completed informed consent to participate. Finally, the resulting analytic sample involved 46,084 subjects (Figure 2).

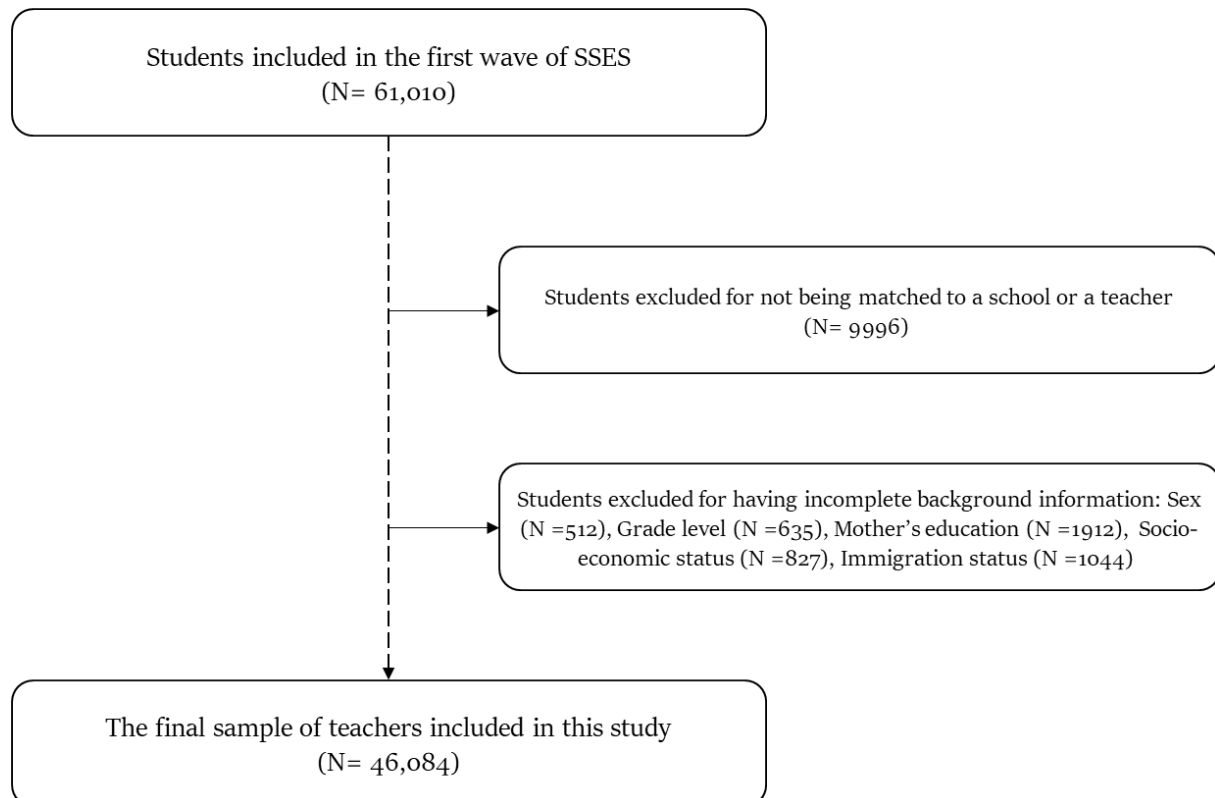


Figure 2. Participants' inclusion criteria.

2.1. Measures

SSES questionnaires comprised items adopted from established sources, known for their reliability in measuring personality traits (OECD, 2021a). Items underwent extensive testing to evaluate their reliability and consistency across different country contexts. This initial testing process was followed by a final selection aimed to retain reliable and valid items for the final assessment in order to ensure the accuracy and precision of evaluating targeted constructs (OECD, 2021b).

To account for the potential influence of student sociodemographic characteristics, the analytical model incorporated several covariates. Gender was coded as 1 = female, 0 = male. Students' grade levels were measured on a continuous scale from 1 to 12, corresponding to the student's level of schooling. Academic achievement was defined as the average of students' cognitive test results across math, reading, and arts, with possible scores ranging from 0 to 100. Mother's education level was coded as 1 = ISCED Level 4 or above, 0 = ISCED Level 3 and below, which indicates maternal educational achievement. Socioeconomic status was quantified using a composite indicator of parents' occupational status. Lastly, immigration status was categorized as 1 = native-born, 0 = otherwise.

2.1.1. Student-Driven Instruction

Student-driven instruction is measured using a six-item scale in the SSES teachers' questionnaire (Table 1). Teachers' responses were recorded on a four-point Likert scale, where the sampling adequacy test (KMO) result is recorded as 0.87. Factor loading results range from 0.69 to 0.82; all of the reported results indicate that this construct is empirically supported.

Table 1. Latent measurement characteristics for student-driven instruction.

Items (Student-Driven Instruction, SdI) (KMO = 0.87, $\chi^2 = 12,570.67$)	Mean (SD)	Factor Loading (λ)
Get students to believe they can do well in school work (TCQM01601)	3.41 (0.65)	0.79
Help my students to value learning (TCQM01602)	3.43 (0.66)	0.82
Motivate students who show low interest in school work (TCQM01604)	3.18 (0.75)	0.78
Make expectations about student behavior clear (TCQM01605)	3.44 (0.64)	0.73
Help students think critically (TCQM01606)	3.30 (0.71)	0.76
Get students to follow classroom rules (TCQM01607)	3.48 (0.62)	0.69

Note. KMO = Kaiser–Meyer–Olkin measure of sampling adequacy. χ^2 = Bartlett's test-of-sphericity statistic ($df = 15$, $p < 0.001$).

2.1.2. Student Curiosity

Student curiosity is analyzed utilizing a six-item scale from the SSES students' questionnaire (Table 2). Students' responses were recorded on a five-point Likert scale, where the sampling adequacy test (KMO) result is recorded as 0.83. Factor loading results range from 0.58 to 0.79; all of the reported results indicate that this construct is empirically valid.

Table 2. Latent measurement characteristics for student curiosity.

Items (Student Curiosity, SC) (KMO = 0.83, $\chi^2 = 91,826.08$)	Mean (SD)	Factor Loading (λ)
I am curious about many different things (STA0401)	4.12 (0.90)	0.58
I am eager to learn (STA0402)	3.92 (0.95)	0.73
I like to ask questions (STA0403)	3.66 (1.05)	0.61
I like to know how things work (STA0404)	4.08 (0.85)	0.67
I like learning new things (STA0405)	4.22 (0.83)	0.79
I love learning new things in school (STA0407)	3.94 (0.95)	0.75

Note. KMO = Kaiser–Meyer–Olkin measure of sampling adequacy. χ^2 = Bartlett's test-of-sphericity statistic ($df = 15$, $p < 0.001$).

2.1.3. Student Agency

Student agency is measured using a twelve-item scale from the SSES students' questionnaire (Table 3). Students' responses were recorded and rated on a five-point Likert scale, where the sampling adequacy test (KMO) result is recorded as 0.90. Factor loading results range from 0.72 to 0.84; the reported results indicate good item reliability and validity.

Table 3. Latent measurement characteristics for student agency.

Items (Student Agency, SA) (KMO = 0.90, $\chi^2 = 20,245.23$)	Mean (SD)	Factor Loading (λ)
Keep working on a task until it is finished (STA1301)	3.83 (0.98)	0.80
Finish what I start (STA1304)	3.82 (0.95)	0.82
Finish things despite difficulties in the way (STA1310)	3.74 (0.94)	0.79
Wake up happy almost every day (STA0903)	3.34 (1.20)	0.78

Table 3. Cont.

Items (Student Agency, SA) (KMO = 0.90, $\chi^2 = 20,245.23$)	Mean (SD)	Factor Loading (λ)
Always positive about the future (STA0904)	3.75 (1.08)	0.80
Look at the bright side of life (STA0907)	3.80 (1.05)	0.84
Reliable and can always be counted on (STA0702)	4.01 (0.91)	0.72
Keep my promises (STA0705)	4.13 (0.80)	0.78
A responsible person (STA0706)	3.87 (0.92)	0.76
Get along well with others (STA1803)	4.03 (0.85)	0.75
Always willing to help my classmates (STA1807)	3.98 (0.90)	0.76
Polite, courteous to others (STA1809)	4.05 (0.85)	0.76

Note. KMO = Kaiser–Meyer–Olkin measure of sampling adequacy. χ^2 = Bartlett’s test-of-sphericity statistic ($df = 66$, $p < 0.001$).

2.2. Data Analysis

Statistical analysis for this study was conducted utilizing STATA (version 15.1, Stata Corp LLC, College Station, TX, USA) on a dataset comprising 46,084 records from the Survey of Social and Emotional Skills. Methodologically, structural equation modelling (SEM) is lauded for its capacity to statistically quantify levels of mediation that correspond with theoretical hypotheses (Liu & Aziku, 2025). This study encompassed the computation of descriptive statistics as well as estimation of inter-construct correlations. Furthermore, the analytical assessment extended to the examination of path coefficients for both direct and indirect effects (Shah & Goldstein, 2006). Mediation effects were rigorously evaluated using three distinct tests—Delta, Sobel, and Monte Carlo—employing 5000 bootstrap sampling to ensure goodness-of-fit.

3. Results

3.1. Descriptive Analysis

This study incorporated a multi-site sample of 46,084 students, as reported and summarized in Table 4. The gender distribution was approximately balanced, with 51% female participants. Students represent a mean grade level of 7.00 (SD = 2.74). Furthermore, academic performance is recorded with an average score of 57.08 (SD = 32.21), suggesting substantial variation. Moreover, parents of 57% of the sample had education level of ISCED 4 or above, and that average socioeconomic index was 0.23 (SD = 0.99). Finally, a majority (82%) of the sample were native-born.

Table 4. Participant characteristics.

Background Variables	Definition	Mean	SD
Female	Female = 1, Males = 0	0.51	-
Grade level	Student grade level (1–12)	7.00	2.74
Academic achievement	Arithmetic means of student test scores on math, reading, and arts (0–100)	57.08	32.21
Mother’s education	ISCED Level 4 or above = 1, Level 3 or below = 0	0.57	-
Socioeconomic index	Composite index of parental occupational status	0.23	0.99
Immigrant status	Natives = 1, Immigrants = 0	0.82	-

3.2. SEM Analysis

For model goodness-of-fit, several key measures are reported, including CFI = 0.97, TLI = 0.96, RMSEA = 0.054, and SRMR = 0.038; the CFI and TLI statistics indicate a good model fit at 0.90, while the RMSEA and SRMR statistics are below the recommended

upper-bound limits of 0.06 and 0.08, respectively. Additionally, in order to verify measurement quality, composite reliability (CR), internal consistency reliability (Cronbach's α), convergent validity (AVE), and discriminant validity (HTMT) were assessed for all latent variables (Table 5). Accordingly, all metrics satisfy satisfactory requirements (Henseler et al., 2015; Hooper et al., 2008).

Table 5. Latent variables quality assessment.

Latent Variable	(AVE)	(HTMT) < 0.85–0.90	Cronbach's α	CR
Student-Driven Instruction	0.66	Valid	0.86	0.89
Student Curiosity	0.64	Valid	0.78	0.83
Student Agency	0.65	Valid	0.85	0.95

Note. AVE = average variance extracted; HTMT = Heterotrait–Monotrait ratio; CR = composite reliability.

Table 6 presents point estimates for standardized direct and indirect effects. The statistical analysis shows complicated interactions between student-driven instruction, agency, and curiosity (see Figure 3). On the one hand, for direct effect pathways, the standardized coefficient (β) results indicate that student-driven instruction is significantly associated with student agency ($\beta = 0.094$, $p < 0.001$), with a 95% CI of [0.083, 0.104], and student curiosity ($\beta = 0.043$, $p < 0.001$), with a 95% CI of [0.035, 0.051]. The results also show that student agency is significantly associated with student curiosity ($\beta = 0.78$, $p < 0.001$), with a 95% CI of [0.775, 0.787]. On the other hand, for indirect pathways, student agency significantly mediates the positive link between student-driven instruction and student curiosity ($\beta = 0.073$, $p < 0.001$), with a 95% CI of [0.065, 0.082]. The standardized beta coefficient for the total association between student-driven instruction and student curiosity is estimated to be 0.117 ($p < 0.001$). The mediating role of student agency is noteworthy, the indirect effect of student-driven instruction on student curiosity is operating significantly through student agency.

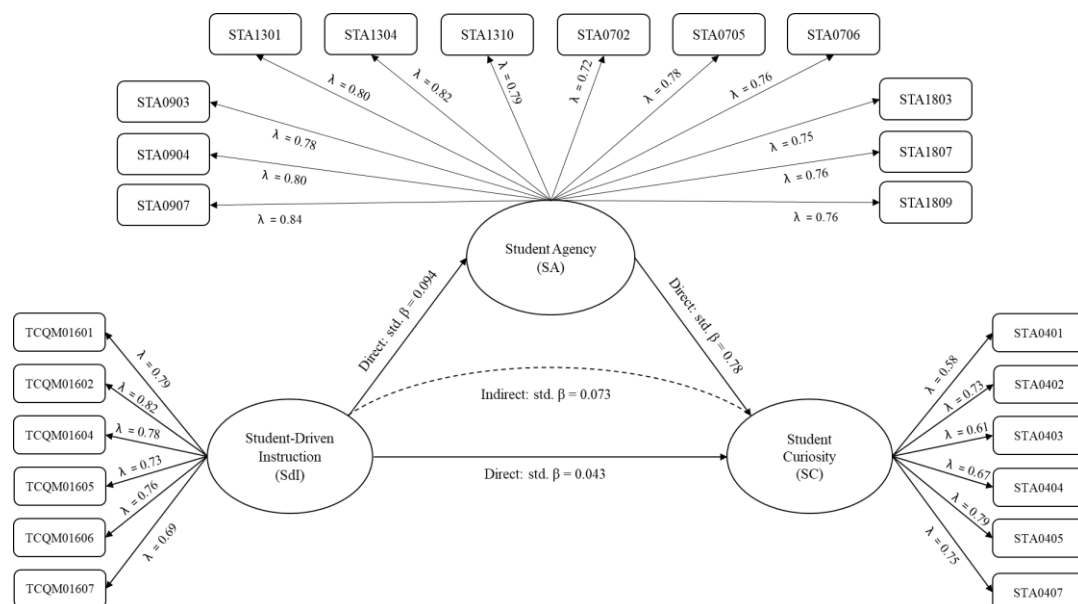


Figure 3. SEM results with latent variables and path relationships.

Table 6. Structural equation model results for mediation analysis.

Pathways	Std. β	Z-Value	p-Value	[95% CI]
Direct effect				
SdI $\rightarrow$ SA	0.094	17.34	0.001	[0.083, 0.104]
SA $\rightarrow$ SC	0.78	72.90	0.001	[0.775, 0.787]
SdI $\rightarrow$ SC	0.043	10.16	0.001	[0.035, 0.051]
Indirect effect				
SdI $\rightarrow$ SA $\rightarrow$ SC	0.073	17.08	0.001	[0.065, 0.082]

Note. SdI = student-driven instruction; SA = student agency; SC = student curiosity; CI = Confidence Interval.

4. Discussion

The present study aimed to examine research questions regarding the influence of student-driven instruction on student curiosity. Although a substantial body of literature has highlighted the positive effects of student-driven instructional practices on learners' academic outcomes (e.g., [Darling-Hammond et al., 2020](#); [Reigeluth et al., 2016](#); [Weissberg et al., 2015](#)), while emphasizing the relevance of creating inclusive and supportive environments for enhancing the academic achievements and educational milestones of students ([Freeman et al., 2014](#)), little research examines the direct and indirect relationships between instructional practices and personal traits. In this light, findings of this study suggest that the learning process is enriched when learners are viewed as proactive meaning-makers rather than passive recipients of knowledge, supporting empirical evidence from the existing literature ([Blinkoff et al., 2023](#); [Chen & Jordan, 2024](#)). Results highlight the importance of instructional strategies that bolsters students' desire for pursuit of knowledge. Consistent with previous research, results seem to confirm that prioritizing the implementation of student-driven instruction can effectively nurture learners' sense of inquisitiveness through offering opportunities for students to take a leading role in their own learning ([Evans et al., 2023](#); [Markant & Gureckis, 2014](#)).

Furthermore, the present study sheds light on the positive and significant association between student-driven instruction and student agency, revealing a statistically significant direct effect ($\beta = 0.094$ $p < 0.001$). In line with [Ashwin and McVitty \(2015\)](#), student-driven instruction is the quantum of the decision-making authority or agency ceded to learners. More concretely, the degree to which students exercise autonomy in determining the content, modality, and temporality of their learning experiences can significantly intensify their overall educational encounters. These results underscore the efficacy of student-driven instruction in fostering learners' active participation in the classroom, where class time is more likely to be used for building knowledge, group discussion, and expanding students' autonomy to enhance their control over learning. In this regard, when teachers become more agency-supportive, it grants their students the freedom to select and organize curricular materials and content to meet their own learning needs ([Sengupta-Irving & Enyedy, 2015](#)). In addition, this study uncovers positive and significant associations between student agency and student curiosity ($\beta = 0.78$, $p < 0.001$). This substantial and notable relationship indicates that students who are empowered as agents of their own learning often exhibit a greater propensity to explore new things ([Hulme et al., 2013](#); [Schutte & Malouff, 2019](#)).

In an attempt to unpack the association between student-driven instruction and student curiosity through student agency, the present analysis revealed that the implementation of student-driven instruction has an indirect positive effect on curiosity ($\beta = 0.073$, $p < 0.001$). A probable explanation behind this significant indirect effect of student-driven instruction is that promoting student curiosity is linked to the cultivation of the student's level of autonomy in the classroom ([Bergin, 2016](#)). In this context, teachers play a fundamen-

tal role in nurturing students' personal and academic competencies by establishing a secure and stimulating learning environment. A large body of literature indicates that the establishment of an appropriate learning atmosphere correlates positively with learners' interest and curiosity, achieved through the empowerment and support of learners in engaging in meaningful educational activities (Slavich & Zimbardo, 2012), with the development of these skills being closely connected to student agency (Kelly et al., 2022). Accordingly, class objectives may shift from teacher-focused directives to activities that actively encourage learners to take a greater responsibility in determining their existing information, identifying knowledge gaps, and articulating their curiosity (Chen & Jordan, 2024). To this end, these findings imply that student-driven instruction may serve as a potent educational intervention, enriching learning outcomes and cultivating an engaging environment that is instrumental in students' active participation in learning endeavors; such an approach not only motivates students to engage in inquiry, exploration, and discovery, but also strengthens their innate curiosity.

Despite the study's contributions to the existing body of evidence, it is imperative to acknowledge two notable limitations. Firstly, the cross-sectional design of the study inherently inhibits the ability to infer causality and may limit the interpretability of the findings. Secondly, the reliance on teacher self-reports for measuring constructs such as student-driven instruction, without supplementary validation methods, may introduce measurement errors potentially attributable to participant bias. For future research, a longitudinal study design could provide more robust evidence for causal relationships. Additionally, incorporating qualitative data, such as in-depth interviews, could offer a richer and more holistic indicator of social and emotional abilities.

5. Conclusions

The present study examined the intricate interactions among student-driven instruction, agency, and curiosity. Results from structural equation modeling (SEM) have uncovered a significant positive association between student-driven instruction and curiosity, as mediated by agency. Findings may represent significant implications for educational practitioners and policy makers on the pivotal role of instruction and pedagogy in nurturing student curiosity. These insights provide a valuable foundation for school reform initiatives aimed at supporting learner-led methods and enhancing students' abilities for self-directed learning. Prioritizing a transition from traditional approaches to more learner-led instructional techniques may help teachers to better facilitate rather than dictate learning, while fostering safe and exciting environments that promote students' sense of curiosity and exploration. Additionally, given the critical role of student agency revealed in this study, the pedagogical value of teachers may benefit from being supportive of personal accountability among learners and encourage self-directed proactive learning for their own endeavors. Finally, bolstering student agency is a natural reflection of supporting one's intent to lead and transform, which may present especially critical value as students grow and flourish, hence, the value of implementing student-driven instruction is not only on student curiosity alone, but more broadly empowering them to take more active roles as collaborative partners in jumpstarting their lifelong learning processes.

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Institutional Review Board Statement: The database used in the present study is a part of an international survey conducted by the Organization of Economic Cooperation and Development (OECD), which has undergone rigorous ethical review, and is publicly available.

Informed Consent Statement: Informed consent was obtained from all participants involved in the study.

Data Availability Statement: Data used in the current study is publicly available on the OECD website at <https://www.oecd.org/en/data/datasets/SSER-Round-1-Database.html> (accessed on 1 January 2024).

Conflicts of Interest: The authors declare no conflict of interest.

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