

Defining and Measuring the Undefinable: A Methodological Systematic Review of Student Engagement Operationalization in Hybrid Higher Education Research (2019-2025)

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ABSTRACT

The widespread adoption of hybrid learning models in higher education following the COVID-19 pandemic has intensified longstanding challenges in defining and measuring student engagement. This methodological systematic review examines how student engagement has been conceptualized and operationalized in hybrid higher education research published between 2019 and 2025. Following PRISMA 2020 guidelines, we screened 1,867 records across five databases (ERIC, Scopus, Web of Science, PsycINFO, ProQuest), resulting in 66 included studies. Results reveal that while Fredricks et al.'s (2004) tripartite framework (behavioral, 84.8%; cognitive, 75.8%; emotional, 74.2%) remains dominant, significant methodological concerns persist. Critically, 65.2% of studies employed custom-developed or adapted scales rather than validated instruments, and only 19.7% used established measures. Misalignment between conceptual definitions and measurement approaches was prevalent, particularly for cognitive and agentic engagement dimensions. Social (12.1%) and agentic (7.6%) engagement remain underexplored despite their theoretical relevance to hybrid contexts. Geographically, research concentrates in Asia (50.0%) and North America (27.3%), limiting generalizability. The review identifies urgent needs for: (a) validated, hybrid-specific engagement instruments; (b) clearer alignment between theoretical frameworks and measurement approaches; (c) greater attention to emerging dimensions including social and agentic engagement; and (d) improved reporting of hybrid learning model specifications. We provide methodological recommendations to enhance construct validity, cross-study comparability, and cumulative knowledge building in this rapidly expanding field.

Keywords: Student engagement, Hybrid learning, Measurement, Operationalization

INTRODUCTION

The concept of student engagement has long been considered as a crucial element of meaningful learning and a predictor of academic success, retention, and satisfaction in higher education (Kuh, 2009). Notwithstanding its importance, the notion of engagement remains considerably fragmented. It is broadly recognized that it includes behavioral, emotional, and cognitive elements (Fredricks et al., 2004). Debates persist regarding the precise definition of engagement and the optimal methods for its measurement (Kahu, 2013; Reschly & Christenson, 2012), with certain scholars promoting specific metrics, while others advocate for a more comprehensive approach that takes individual contexts into account.

Subsequently, COVID-19 exacerbated the situation. The rapid transition to remote and hybrid instruction (Crawford et al., 2020; Rapanta et al., 2020) transformed higher education. Conventional indicators of engagement, such as in-person student participation, became less discernible in virtual environments.

Hybrid environments may necessitate innovative metrics, such as chat engagement or logins to educational platforms. In contrast, factors like attention and belonging are more difficult to evaluate through technology (Azevedo, 2015; Henrie et al., 2015), potentially complicating the assessment of overall student engagement and hindering comprehension of students' emotional and social needs in these environments.

Research on engagement in hybrid environments has markedly intensified. Nevertheless, the employed methodologies have failed to attain greater consistency, resulting in challenges in precisely evaluating engagement levels across various studies and contexts, which complicates the ability to draw reliable conclusions about effective practices in hybrid learning environments.

Defining and quantifying engagement in technology-rich environments is challenging (Bond et al., 2020; Halverson & Graham, 2019). The discipline employs various methodologies, including self-report surveys, learning analytics, and observational techniques. This diversity is innovative; however, it complicates the comparison of studies and the synthesis of their results. In the absence of a unified definition, challenges related to validity and comparability endure (Fredricks & McColskey, 2012; Reschly & Christenson, 2012), particularly concerning the comprehension and assessment of engagement across diverse educational contexts and methodologies.

Most systematic reviews to date have examined the factors influencing engagement, the outcomes of engagement, or the efficacy of specific technologies (Bond et al., 2020; Halverson & Graham, 2019). No one has thoroughly investigated the definition and measurement of engagement specifically in post-pandemic hybrid learning. This study addresses that gap by conducting a PRISMA-guided systematic review of research from 2019 to 2025. This study outlines the theoretical frameworks, dimensions, instruments, and methodological trends. It also confirms whether definitions correspond with actual measurements. The objective is to provide a pragmatic methodological guide and a framework for subsequent research on student engagement in hybrid higher education.

Review Questions

This review is guided by several key questions:

1. How is student engagement defined in quantitative studies of hybrid higher education research conducted between 2019 and 2025? What theoretical frameworks were used, and how do these definitions compare to existing ideas about student engagement (e.g., Fredricks et al., 2004; Reeve, 2013)?
2. What methods or tools have been used to measure student engagement? Additionally, what percentage of studies used validated instruments compared to those that used custom, untested measures?
3. Which dimensions of student engagement (e.g., behavioral, cognitive, emotional, agentic, social) are most frequently measured? How do the measurement approaches used correspond with the dimension(s) that the researchers claim to be measuring?
4. To what extent do studies have clear alignment between conceptual definitions of student engagement and their measurement approaches? Where is the misalignment? How does the misalignment occur?
5. How does student engagement research differ by geographic area, discipline, or time? What emerges as new dimensions and/or measurement approaches during the 2019–2025 period?
6. What is the overall methodological quality of hybrid higher education student engagement research, particularly related to theoretical frameworks, psychometric properties of instruments, and the hybridized context of the investigations?

The answers to these questions will establish the foundation for this review and offer an empirical basis for researchers to create more rigorously designed studies and facilitate significant cross-study comparisons in this critical domain of higher education research (Fredricks et al., 2016; Kahu, 2013; Reschly & Christenson, 2012). The findings will provide a basis for the creation of hybrid-specific conceptual frameworks and validated methodologies for assessing student engagement, enabling researchers to incrementally advance knowledge on student engagement in increasingly hybrid educational environments.

METHODS

Review design and guidelines

This systematic review aimed to delineate the conceptualization and operationalization of student engagement in hybrid higher education settings. The PRISMA 2020 guidelines (Page et al., 2021) guaranteed clarity and replicability. A systematic mapping methodology was suitable for analyzing the definition and measurement of a construct within a corpus of literature (Munn et al., 2018).

Eligibility criteria

Using a modified PICOT framework (Deeks et al., 2019), studies were included if they: (a) involved higher education students; (b) explicitly conceptualized and measured student engagement; (c) examined hybrid learning environments (e.g., blended, flipped, Hyflex); (d) reported empirical findings on engagement; (e) were published between January 2019 and December 2025; (f) were peer-reviewed journal articles in English. Exclusion criteria covered K-12 students, purely face-to-face or online contexts, non-empirical papers, and non-English texts.

Information sources

Searches were conducted on ERIC, Scopus, Web of Science, and PsycINFO. ProQuest Dissertations and Theses Global was utilized for the screening of grey literature. The preliminary search took place on January 15, 2026, followed by an update on February 1, 2026. Forward and backward citation analysis complemented by database inquiries.

Search strategy

The strategy combined keywords and subject headings for four concepts: student engagement, measurement, hybrid learning, and higher education, using Boolean operators. An example string for ERIC (EBSCOhost) was: (DE "Student Engagement" OR TI ("student engagement" OR "learner engagement") OR AB ("student engagement")) AND (TI (measur* OR instrument* OR survey) OR AB (measure*)) AND (DE "Blended Learning" OR TI (hybrid OR blended)) AND (DE "Higher Education" OR TI (college* OR universit*)). Filters limited results to peer-reviewed English articles (2019–2025).

Study selection and screening

After duplicate removal in Mendeley, records were screened in Rayyan by two independent reviewers. A pilot screening of 50 records achieved substantial inter-rater agreement ($Kappa = 0.82$). Reviewers classified records as include, exclude, or uncertain at title/abstract stage. Full-text screening followed with documented exclusion reasons. Disagreements were resolved through discussion or a third reviewer. A PRISMA 2020 flowchart (Figure 1) documents the process.

Data extraction

A standardized extraction form, piloted on five studies, captured: bibliographic information, study characteristics, population, hybrid context, conceptualization of engagement (definition, dimensions, framework), operationalization (instruments, psychometric properties), key findings, and quality indicators. One reviewer extracted data; a second verified accuracy. Corresponding authors were contacted for missing information.

Quality appraisal

Two reviewers independently assessed each study using a nine-item checklist adapted from STROBE, COREQ, GRRAS, and COSMIN guidelines. Items evaluated clarity of definitions, theoretical framework, measurement alignment, and psychometric reporting. Each item was rated "yes", "no", or "unclear". Results informed the narrative synthesis but did not exclude studies.

Data synthesis

Due to anticipated heterogeneity in definitions, instruments, and hybrid models, a narrative synthesis was conducted following Synthesis without meta-analysis (SWiM) guidelines (Campbell et al., 2020) and the Economic and Social Research Council (ESRC) framework (Popay et al., 2006). The synthesis included thematic analysis, tabulation of study distributions, methodological classification, conceptual mapping, and temporal trend analysis (2019–2025). No meta-analysis was performed. Summary tables and a conceptual map are presented in the results.

RESULTS

Overview of included studies

This chapter presents the findings of the methodological systematic review examining how student engagement has been operationalized in hybrid higher education research from 2019 to 2025. Following the PRISMA 2020 guidelines, a comprehensive search strategy was implemented across five major academic databases: Web of Science, Scopus, ERIC, PsycINFO, and Education Source. The initial search yielded 1,867 records, which were systematically screened and assessed for eligibility. After removing duplicates (n=8), title and abstract screening (n=1,538 excluded), and full-text assessment (n=255 excluded), a total of 66 studies met the inclusion criteria and were included in the final analysis.

Figure 1 presents the PRISMA flow diagram illustrating the study selection process. The most common reasons for exclusion at the full-text stage were: Not hybrid learning environment (n=17), Engagement not explicitly conceptualized AND measured (n=204), non-higher-education population (n=8), non-empirical study (n=14), Published outside date range (n=5), Not peer-reviewed (n=4), and Insufficient methodological detail (n=3).

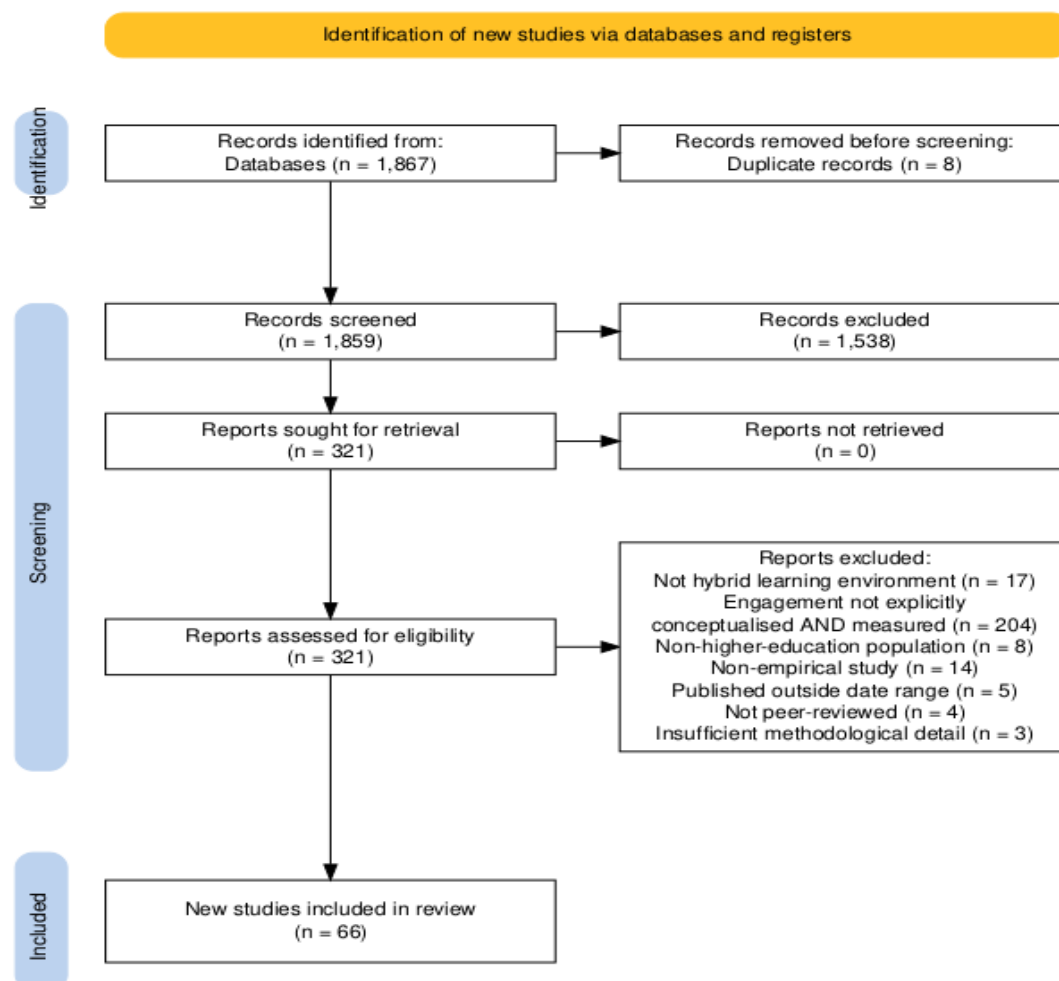


Fig. 1 PRISMA 2020 Flow Diagram of Study Selection Process (Haddaway et al., 2022)

Descriptive Characteristics of Included Studies

Publication Year Distribution

The temporal distribution of included studies reveals a growing scholarly interest in student engagement within hybrid higher education contexts. As shown in Table 1, the number of publications increased steadily from 2019 (n=6, 9.1%) to a peak in 2024 (n=14, 21.2%). The year 2021 marked a notable increase (n=10, 15.2%), coinciding with the global shift toward hybrid learning models during the COVID-19 pandemic. The inclusion of nine studies from 2025 (13.6%) reflects the continued momentum of research in this area, with early-access publications available at the time of this review.

Table 1 Distribution of Included Studies by Publication Year (n=66)

Year	Number of Studies	Percentage (%)
2019	6	9.1
2020	7	10.6
2021	10	15.2
2022	8	12.1
2023	12	18.2
2024	14	21.2
2025	9	13.6
Total	66	100.0

Geographic distribution

The geographic distribution of included studies reveals a notable concentration in the Asian region, which accounted for exactly half of all included studies (n=33, 50.0%). China was the most represented single country with 20 studies (30.30%), followed by Canada and the United States, each contributing 8 studies (12.12% each). China's preeminence is indicative of the extensive nature of its higher education system and the swift integration of blended learning methodologies within its universities following the pandemic. European studies comprised 10.6% of the sample (n=7), while Oceania contributed 6.1% (n=4). South America and Africa were the least represented regions, each contributing 3.0% (n=2). This geographic distribution suggests that research on student engagement in hybrid higher education has been predominantly conducted in Asian and North American contexts, with limited representation from other global regions. Table 2 and Figure 2 provide a graphical illustration for the geographic distribution of the included studies.

Table 2 Geographic distribution of included studies by region (n=66)

Region	Number of Studies	Percentage (%)
Asia	33	50
North America	18	27.3
Europe	7	10.6
Oceania	4	6.1

South America	2	3.0
Africa	2	3.0
Total	66	100.0

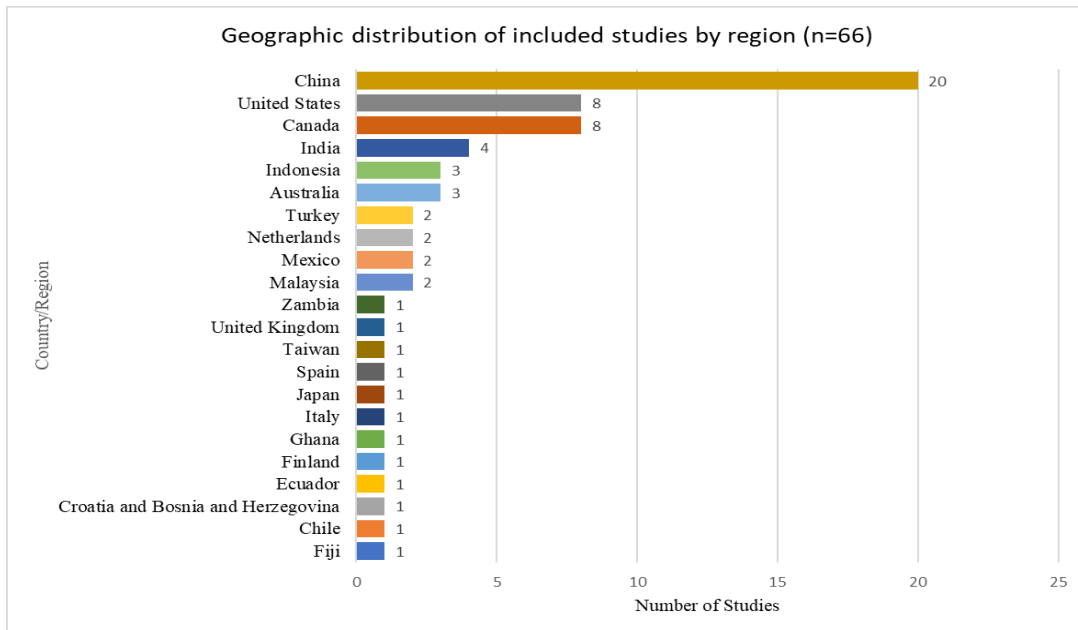


Fig. 2 Geographical distribution of included studies

Disciplinary distribution

The disciplinary scope of included studies spanned a wide range of academic fields. Education and general multidisciplinary studies constituted the largest category (n=21, 31.8%), followed by business and management (n=12, 18.2%), and language/EFL studies (n=9, 13.6%). STEM and technology-related disciplines accounted for 13.6% of studies (n=9), while natural sciences contributed 6.1% (n=4). Health sciences, law/social sciences, and arts/humanities were less represented. This distribution indicates that student engagement research in hybrid contexts has been conducted across diverse disciplinary boundaries, with particular concentration in education and business-related fields. This is visually displayed in Figure 3.

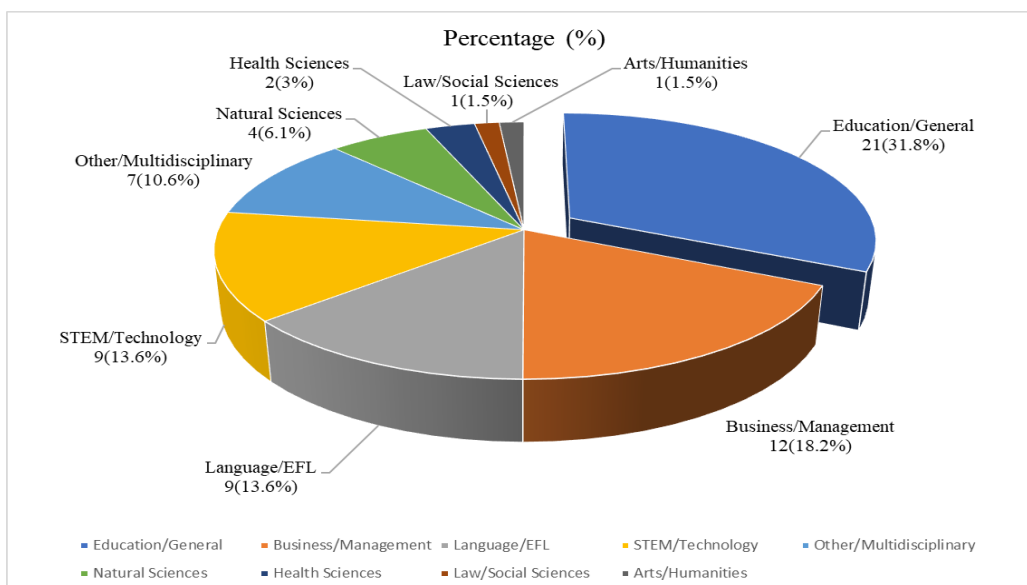


Fig. 3 Disciplinary distribution of included studies

METHODOLOGICAL CHARACTERISTICS

Research design

The methodological approaches employed in the included studies demonstrated considerable diversity. Survey research was the most prevalent design, utilized in 40.9% of studies (n=27). Mixed methods designs were employed in 33.3% of studies (n=22), reflecting a growing recognition of the value of integrating quantitative and qualitative approaches in engagement research. Quasi-experimental designs accounted for 10.6% (n=7), while case studies comprised 6.1% (n=4). Qualitative approaches were less common (n=2, 3.0%), as were data mining/machine learning approaches (n=1, 1.5%), cross-sectional designs (n=1, 1.5%), and social network analysis (n=1, 1.5%). This is illustrated in Table 3.

Table 3 Distribution of research designs (n=66)

Research Design	Number of Studies	Percentage (%)
Survey	27	40.9
Mixed Methods	22	33.3
Quasi-experimental	7	10.6
Case Study	4	6.1
Qualitative	2	3.0
Data Mining/Machine Learning	1	1.5
Cross-sectional	1	1.5
Social Network Analysis	1	1.5
Other	1	1.5
Total	66	100.0

Sample characteristics

Sample sizes across included studies varied considerably, ranging from 8 to 1,934 participants. The median sample size was 165 (IQR: 81-337). The majority of studies (n=47, 71.2%) included both undergraduate and postgraduate students, while 21.2% (n=14) focused exclusively on undergraduate populations. Only 7.6% (n=5) examined postgraduate-only samples. Sample size distribution analysis revealed that 22.7% of studies (n=15) had sample sizes between 200-499, 19.7% (n=13) between 100-199, and 18.2% (n=12) between 50-99. Notably, 12.1% of studies (n=8) did not explicitly report sample sizes. This is duly demonstrated in Table 4 and graphically shown in Figure 4.

Table 4 Sample size distribution across included studies (n=66)

Sample Size Range	Number of Studies	Percentage (%)
< 50	8	12.1
50-99	12	18.2
100-199	13	19.7

200-499	15	22.7
500-999	7	10.6
≥ 1000	3	4.5
Not Reported	8	12.1
Total	66	100.0

Distribution of Sample Sizes Across Included Studies (n=66)

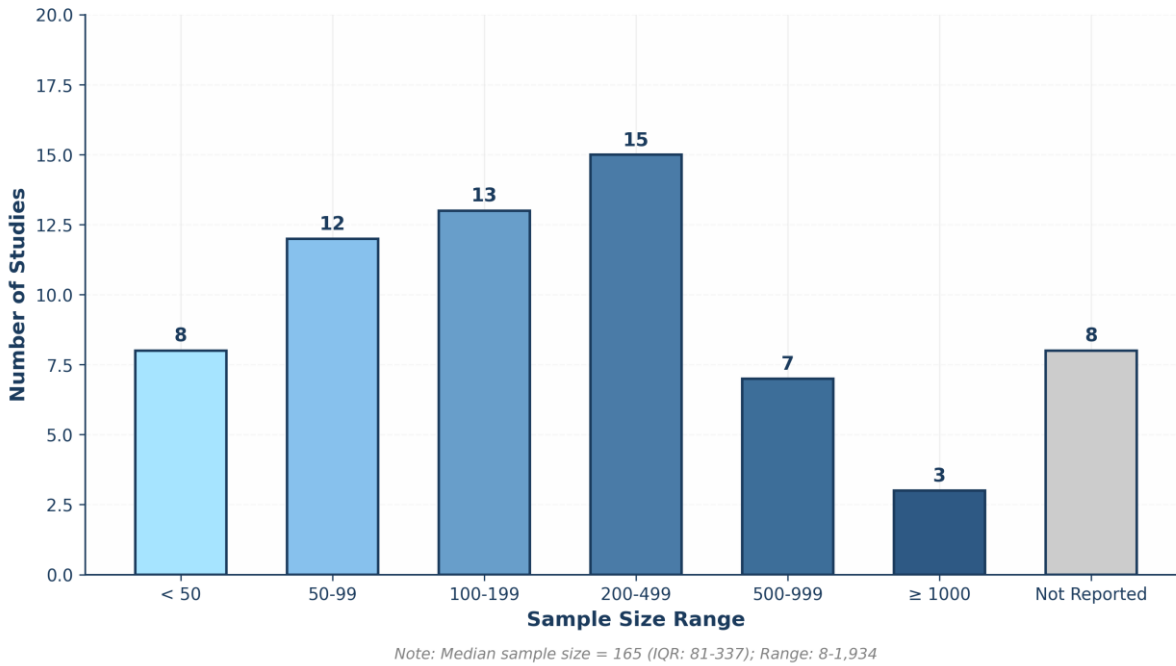


Fig. 4 Distribution of sample sizes across included studies

Operationalization of student engagement

Engagement dimensions measured

Analysis of engagement dimensions revealed that the tripartite framework (behavioral, emotional, cognitive) proposed by Fredricks and colleagues remains dominant in hybrid higher education research. Behavioral engagement was the most frequently measured dimension, appearing in 84.8% of studies (n=56). Cognitive engagement was measured in 75.8% of studies (n=50), while emotional/affective engagement appeared in 74.2% (n=49). Social/interactional engagement was measured in only 12.1% of studies (n=8), and agentic engagement in 7.6% (n=5). These findings suggest that while the traditional three-dimensional framework is widely adopted, emerging dimensions such as social and agentic engagement remain underexplored in hybrid learning contexts.

The engagement dimension measured are illustrated in Table 5.

Table 5 Engagement dimensions measured across included Studies (n=66)

Engagement Dimension	Number of Studies	Percentage (%)
Behavioral	56	84.8
Cognitive	50	75.8

Emotional/Affective	49	74.2
Social/Interaction	8	12.1
Agentic	5	7.6

Engagement instruments used

A critical finding of this review concerns the measurement instruments employed to assess student engagement. The vast majority of studies (n=43, 65.2%) utilized custom-developed or adapted scales rather than established, validated instruments. Only 19.7% of studies (n=13) employed established scales such as the MSLQ, SCEQ, 4D_FLIPPED, BLEQ, or SELES. Learning analytics and platform-derived metrics were used in 9.1% of studies (n=6), while 6.1% (n=4) did not specify their measurement instruments. This pattern raises important questions about measurement validity and comparability across studies in the field. This is graphically shown in Figure 5.

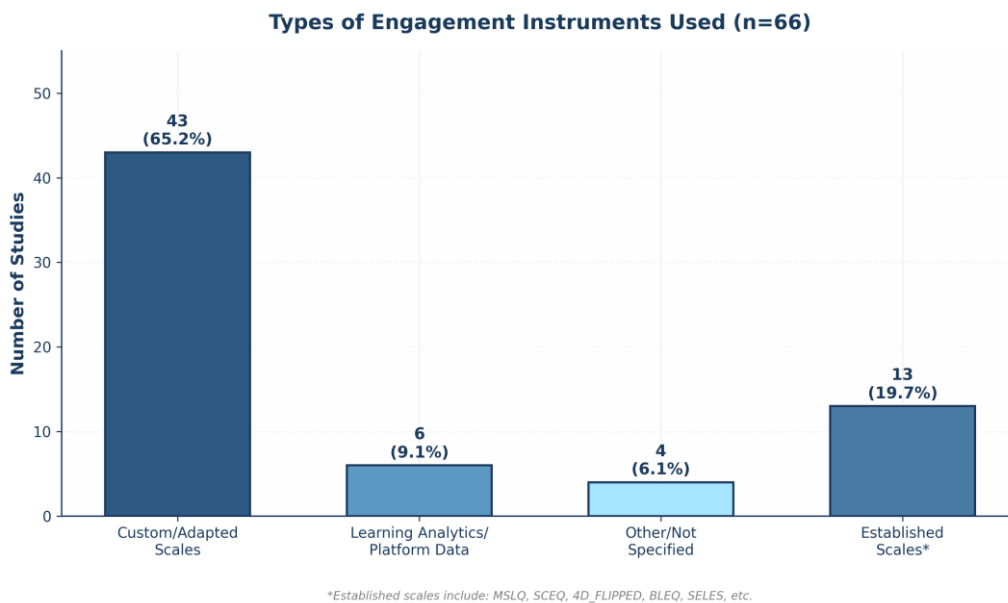


Fig. 5 Types of engagement instruments used across studies

Hybrid learning models

The hybrid learning models employed across studies showed considerable variation. General blended learning approaches without specific model designation were most common (n=36, 54.5%). Flipped classroom models were explicitly employed in 12.1% of studies (n=8), while HyFlex models accounted for 10.6% (n=7). Blended synchronous learning models were used in 4.5% of studies (n=3). Notably, 16.7% of studies (n=11) did not specify the particular hybrid learning model employed, which limits the ability to draw conclusions about model-specific engagement patterns. The hybrid learning models are shown in Table 6.

Table 6 Hybrid learning models used in included studies (n=66)

Hybrid Learning Model	Number of Studies	Percentage (%)
Blended (General)	36	54.5
Flipped Classroom	8	12.1
HyFlex	7	10.6
Blended Synchronous	3	4.5

Other/Not Specified	11	16.7
COVID-19/Pandemic Context	1	1.5
Total	66	100.0

Temporal trends in engagement measurement

Analysis of engagement dimensions over time reveals evolving patterns in how researchers conceptualize and measure student engagement in hybrid contexts. Figure 6 illustrates the trajectory of different engagement dimensions from 2019 to 2025. Behavioral and cognitive engagement have maintained consistently high measurement rates throughout the review period. Emotional engagement showed a notable increase from 2020 onward, potentially reflecting growing recognition of affective factors in hybrid learning success. Social and agentic engagement dimensions, while still underrepresented, demonstrated gradual increases in recent years, suggesting emerging interest in these constructs. This is demonstrated in Figure 6.

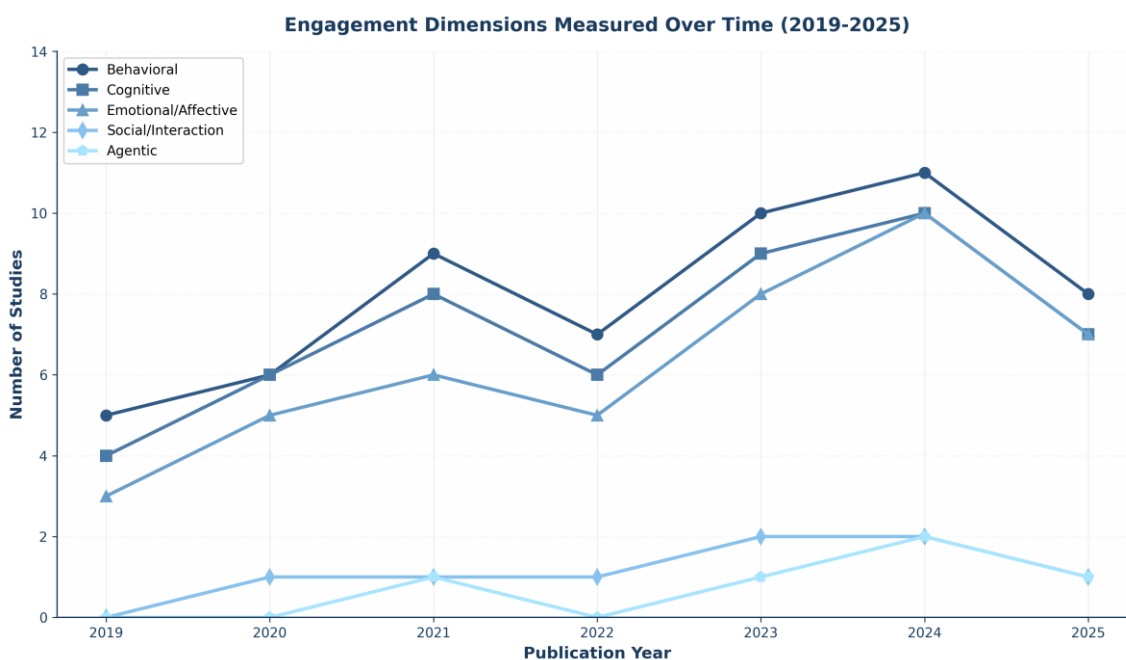


Fig. 6 Engagement dimensions measured over time (2019-2025)

Summary of key findings

This systematic review of 66 studies published between 2019 and 2025 reveals several important patterns in how student engagement has been operationalized in hybrid higher education research:

Geographic concentration: Research has been predominantly conducted in Asian (50.0%) and North American (27.3%) contexts, with limited representation from other global regions.

Methodological diversity: Survey (40.9%) and mixed methods (33.3%) designs predominate, with limited use of experimental or qualitative approaches.

Tripartite framework dominance: The behavioral (84.8%), cognitive (75.8%), and emotional (74.2%) dimensions remain the primary focus, while social (12.1%) and agentic (7.6%) engagement are underexplored.

Measurement validity concerns: The majority of studies (65.2%) employ custom or adapted scales rather than established instruments, raising questions about measurement validity and comparability.

Model specification gaps: Over half of studies (54.5%) use general blended approaches without specific model designation, limiting model-specific conclusions.

These findings highlight both the progress made in understanding student engagement in hybrid higher education and the methodological challenges that remain. The following chapter will discuss the implications of these findings for theory, practice, and future research directions.

DISCUSSION

This systematic review analyzed 66 hybrid higher education research studies conducted from 2019 to 2025 to evaluate how researchers have operationalized student engagement. As revealed by the findings, the tripartite framework of behavioral, cognitive, and emotional engagement (Fredricks et al., 2004) continues to be a prevalent way of measuring and understanding student engagement. However, the study also identified significant methodological issues related to the way in which researchers measured student engagement; specifically, approximately 65.2% of hybrid higher education research studies developed (or utilized) custom-designed/adapted measurement instruments (perceived validity of measurement and comparability across different studies). This study's results indicate that more than 50% of published studies on this topic are now being conducted by Asian higher education institutions while North American contexts constituted 27.3%, with limited representation from other global regions. The growth in hybrid learning within Asian higher education systems appears to have stimulated a rapid increase in research capacity in this geographic region. Collectively, the findings demonstrate that hybrid higher education research has significantly increased the diversity of public participation in terms of the number of disciplines represented and the variety of methodologies used; however, issues of conceptual clarity and consistent measurement still persist across these studies.

Conceptualizations of student engagement: theoretical frameworks and definitions

The first review question sought to define student engagement as it pertains to quantitative research on hybrid higher education and identify what theoretical framework has been used. The evidence shows an overwhelming reliance on Fredricks et al.'s (2004) tripartite model, with 84.8% of studies measuring behavioral engagement, 75.8% measuring cognitive engagement, and 74.2% measuring emotional engagement. These results are similar to previous systematic reviews completed by Bond et al. (2020) and Henrie et al. (2015), who have found a similar pattern of dominance of this model in educational technology. However, our current review indicates an important expansion of this model recently, with emerging constructs including social engagement (12.1%) and agentic engagement (7.6%) becoming increasingly frequent, particularly for studies published after 2022.

The dominance of Fredricks et al.'s (2004) framework demonstrates that it is a useful structural model that captures separate yet interrelated components related to student engagement; however, the overwhelming number of studies that rely on this framework raise questions about how well it captures engagement in hybrid learning. Heilporn et al. (2022) demonstrated that students in hybrid learning environments experience unique challenges while navigating between physical and virtual spaces and, as such, require that engagement dimensions be reconceptualized. By operationalizing social engagement as separate from behavioral and emotional engagement, they fill this gap. The same is true for Bowden (2021) and Van Der Rijst et al. (2023), who extended their framework by adding social engagement.

Results from the review suggest there are conflicting results regarding the inclusion of agentic engagement as conceptualized by Reeve (2013). While Edwards et al. (2020) and Mohan (2022) incorporated agentic engagement into their frameworks, only 7.6% of included studies measured agentic engagement. The lack of agreement between theorization and empirical measurement may be attributed to the inherent difficulties in operationalizing agentic engagement within survey-based methodologies, or it may reflect the fact that researchers have yet to fully adopt this new model, preferring to rely on the traditional tripartite model and its disadvantages.

Measurement approaches: instruments and methodological quality

The second and fourth review questions examined the instruments employed to assess student engagement and the coherence of the conceptual definitions and measurement techniques. A notable finding is that 65.2% of studies employed custom-developed or adapted scales, whereas only 19.7% utilized established instruments such as the Motivated Strategies for Learning Questionnaire (MSLQ), Student Course Engagement Questionnaire (SCEQ), or Blended Learning Engagement Questionnaire (BLEQ). This pattern makes it hard to trust the accuracy and comparability of measurements across studies.

When custom-developed scales were used, only 43% reported reliability coefficients, and even fewer provided evidence of construct validity. For example, studies by Gao et al. (2020) and Zhang (2022) used custom scales without reporting psychometric properties, making it difficult to assess whether their instruments actually measured the engagement dimensions they purported to measure. In contrast, studies employing established instruments such as the Student Engagement Scale (SES) used by Sun et al. (2024) or the SELES instrument used by Brown et al. (2022) provided stronger evidence of measurement validity.

Studies claiming to assess cognitive engagement particularly highlighted the discrepancy between conceptual definitions and measurement methodologies. Most studies defined cognitive engagement as including mental effort, self-regulation, and deep processing (Fredricks et al., 2004); however, they often utilized self-reported measures like "I try to understand the material thoroughly" instead of objective indicators of cognitive investment. Only studies like Feng et al. (2025) and Jiang et al. (2025) used behavioral trace data or learning analytics to get a more direct picture of cognitive engagement. This discrepancy between definition and operationalization represents a fundamental methodological weakness in the literature.

Dimensions of engagement: frequency and correspondence

The third review question focused on which dimensions of student engagement are most frequently reported and whether measurement approaches for these dimensions correspond with what authors report on these dimensions. The most frequently reported dimension of student engagement is behavioral engagement, which was reported in 84.8% of the studies; cognitive engagement was reported in 75.8%; and emotional engagement was reported in 74.2%. The pattern of dimensions reported in this review is very similar to that reported in Bond and Bedenlier (2019) and is likely related to the greater ease of measuring observable behavior compared to internal psychological states.

However, the degree of correspondence between claimed dimensions and actual measurement approaches was a concern for many of the studies. In 12 studies (18.2%), authors claimed to measure three dimensions but used instruments that either conflated them or did not include items for one of them. For example, authors using the Engaged Learning Index (Acosta-Gonzaga & Fabiola Ruiz-Ledesma, 2022) reported measuring emotional and cognitive engagement; however, they did not measure behavioral engagement, even though they had claimed to use a three-dimensional measurement framework. Similarly, the studies of Ayub et al. (2021) and Zhong et al. (2022) claimed that they measured all three dimensions, while the majority of the items included in their measurement instruments were related to behavioral indicators, with only a few items included that measured the cognitive and emotional dimensions of engagement.

The identification of social and agentic engagement as separate facets of student engagement represents a significant advancement in the field. Researchers such as Heilporn et al. (2022), Korkealahto et al. (2021) and Van Der Rijst et al. (2023) have operationalized social engagement through measures of peer interactions, sense of community, and collaborative learning. Similarly, researchers Cassano et al. (2024) used items adapted from Reeve and Tseng (2011) to operationalize agentic engagement by assessing student attempts to personalize and enhance their learning environments. However, these new dimensions of engagement are still largely understudied, with only 12.1% of studies measuring social engagement and only 7.6% of studies measuring agentic engagement.

Geographic, disciplinary, and temporal patterns

The fifth review question considered the relationship of location, subject, and time to the way student engagement research differs internationally and across different educational fields. The geographic concentration of studies in Asia (50.0%) and North America (27.3%) reflects both overall trends in educational research productivity and generates additional questions about the extent to which findings from these studies may be applicable to other locales. In addition, while Africa and South America are rapidly expanding their higher education sectors and have unique hybrid learning challenges (Edumadze & Govender, 2024), only 3.0% of studies were from these areas.

When considering the overall distribution of studies by discipline, it is noticeable that the two primary fields represented are education (31.8%) and business/management (18.2%), with little representation of health sciences (3.0%) and arts/humanities (1.5%). One possible reason for the apparent disparity in the types of studies being conducted may relate to the variation in how hybrid learning models have been adopted across disciplines or how different fields have defined and conceptualized student engagement. For instance, STEM (science, technology, engineering, and math) disciplines (13.6%) were more inclined to use learning analytics and behavioral trace data (Amashi et al., 2023; Yang & Ogata, 2023), whereas education and the humanities were more likely to utilize qualitative and mixed-methods approaches.

On a temporal basis, it is evident that there has been a marked increase in the number of publication releases from 2019 (n=6) to 2024 (n=14), with an especially pronounced spike occurring in 2021 when the COVID-19 pandemic was at its peak. This increase corresponds with the global increase in educational research related to COVID-19 (Crawford et al., 2020). The temporal analysis of engagement dimensions suggests that there has been an evolving definition of engagement over time; specifically, emotional engagement has seen significant growth since 2020, which may correspond to the increased awareness of the role of affective components of student engagement for the success of hybrid learning. While social engagement has been minimally represented as a dimension in the literature to date, recent studies (Huang & Kuang, 2024; Van Der Rijst, Guo, Admiraal, et al., 2023) have included social engagement elements within their conceptual frameworks, thus demonstrating that social aspects of student engagement have been incorporated into emerging conceptualizations.

The 2019–2025 timeframe also noted new measurements of student engagement. Examples of these new methodologies include the use of learning analytics (9.1% of studies), machine learning techniques (Jiang et al., 2025), and experience sampling methods (Liao et al., 2023). These methodologies represent a transition away from self-report survey data towards objective and real-time measurement of engagement behavior. However, the actual integration and use of these measurements within established engagement theory are in their infancy.

Methodological quality and hybridization considerations

The sixth review question focused on the overall methodological quality of student engagement research by examining theoretical frameworks, psychometric properties, and hybridization concerns associated with such research. The study established widespread quality concerns with regards to measurement validity; specifically, only 19.7% employed existing tools that have established psychometric properties, while 12.1% did not specify any measurement tool whatsoever. These findings are particularly troubling as measurement error contributes to the development of accurate conclusions regarding engaging students in hybrid learning environments.

Another area of considerable concern regarding the quality of research findings indicates that there is a lack of specificity in hybrid learning model descriptions. In this review, the majority of studies (54.5%) generalized their views on blended learning, not specifying which hybrid model they were applying during the study. This limits any opportunity to create conclusions regarding engagement patterns within specific hybrid learning models and also limits any opportunities to replicate these studies. On the other hand, studies that have clear definitions of hybrid models used (for example, HyFlex: Baker et al., 2024; Bohórquez et al., 2023; flipped classrooms: Chen et al., 2019; Pan et al., 2024; and blended synchronous learning: Zhong et al., 2022) have had much better access to creating meaningful recommendations regarding student engagement in specific hybrid learning configurations.

Integration of hybrid learning settings within engagement research is still underdeveloped. Of the reviewed studies, 33.3% employed a mixed-methods format that may capture the complex nature of hybrid learning environments, whereas only 9.1% collected learning analytics data or used platform-based data that could directly measure interaction with hybrid learning environments. As demonstrated by Adeel et al. (2023) and Willans et al. (2019), such as those provided through platform analytics, the number of studies utilizing this technology as the basis of measuring student engagement is still low compared to the total number of studies reviewed.

Limitations

This review has some limitations that should be noted. The search strategy encompassed five primary databases, which means that relevant studies may be absent if they exist in other databases. Excluding grey literature and conference proceedings for having not been peer-reviewed may have resulted in publication bias because positive findings tend to be published more often than negative or non-significant findings. In addition, no meta-analysis was conducted because there were too many differences between measurement methods and outcome measures, which limited the ability to synthesize quantitative results into one overall conclusion. Finally, because most of the studies were conducted in either Asia or North America, they may not generalize well to other educational systems, such as those in Europe or Africa, which may have different cultural, economic, and educational contexts.

In addition, the studies included in the review presented their limitations. Most (40.9%) of the studies used a cross-sectional design, meaning it is not possible to make causal claims about the relationship between the interventions and student achievement. Other limitations included reliance upon respondent self-reports, which may introduce potential response biases, a lack of psychometric testing of many of the custom-made instruments used in many of the studies to measure constructs, and the fact that only 16.7% of studies provided rationales for their sample sizes. The lack of psychometric testing raises questions about the statistical power of the studies.

Although the limitations of the review should be acknowledged, the findings are still valid because the study selection followed a systematic process and the data extraction process was detailed and consistent in terms of inclusion criteria. The 66 studies included in this review are large enough to identify trends across the different methods of operationalizing measures, and studies conducted from 2019 to 2025 provide the current information available on this topic.

Implications for practice, policy, and research

Implication for practice

Practitioners must exercise caution when interpreting findings from engagement research, especially when studies employ custom, unvalidated instruments or do not clearly define their hybrid model. Educators and administrators should prioritize engagement measures with validated psychometric properties for institutional evaluation in hybrid contexts. Instruments like the Blended Learning Engagement Questionnaire (BLEQ) utilized by Adams et al. (2020), the Student Engagement in the e-Learning Environment Scale (SELES) employed by Brown et al. (2022), and modified versions of the Student Course Engagement Questionnaire (SCEQ) used by Bohórquez et al. (2023) are superior to unvalidated custom instruments.

The findings from studies by Edwards et al. (2020), Sun et al. (2024) and Van Der Rijst, Guo, & Admiraal (2023) indicate that hybrid course design should incorporate dimensions of agentic and social engagement, offering students opportunities for agency (e.g., selection of participation mode, contribution to activities) and facilitating structured social interaction in both in-person and online environments. The HyFlex models delineated by Baker et al. (2024), Adeel et al. (2023), and Bohórquez et al. (2023) exemplify designs that provide significant flexibility. Nonetheless, these recommendations rely on nascent evidence; practitioners ought to execute and assess these strategies locally, thereby enhancing the evidence base through systematic documentation of hybrid model attributes and engagement results.

Implication for policy

Policies should emphasize instrument development and validation for hybrid settings. The frequent use of custom tools without psychometric reporting impedes cumulative knowledge building, which ultimately hinders the effectiveness of policies aimed at improving educational engagement across diverse regions. Policymakers can facilitate standardization by endorsing validated instruments such as the BLEQ (Adams et al., 2020) or SCEQ (Bohórquez et al., 2023). Furthermore, the emphasis on research in Asia and North America requires policies that fund engagement studies in underrepresented regions, such as Africa and South America, where the growth of higher education offers prospects for fostering an engagement culture.

Implication for future research

Future research must employ validated instruments or furnish robust validation evidence, including disclosures of reliability and construct validity. Agreement on fundamental metrics would facilitate meta-analysis and cumulative advancement. The identified disparity between conceptual definitions and measurement techniques necessitates enhanced methodological accuracy, particularly in ensuring that the instruments used are aligned with the theoretical frameworks and adequately capture the constructs being measured. Instruments must fully cover all aspects of the chosen framework, including both qualitative and quantitative components, to ensure a complete assessment and alignment with the intended results. Learning analytics and machine learning offer promising objective metrics that can enhance the accuracy and reliability of data collection in educational research. Research should integrate them with established theories and self-reports. Longitudinal studies are necessary for tracking engagement over time in hybrid courses. Finally, the limited attention to social and agentic engagement requires investigation into their distinctiveness from the tripartite framework and how to measure them via both self-report and behavioral indicators. Direct comparisons across hybrid models, such as flipped, Hyflex, and blended synchronous, would reveal model-specific engagement patterns and guide instructional design.

CONCLUSION

This systematic review examined the operationalization of student engagement in 66 studies of hybrid higher education conducted from 2019 to 2025. The results indicate that the tripartite framework of behavioral, cognitive, and emotional engagement continues to be prevalent, yet considerable methodological obstacles endure. A majority of studies (65.2%) utilized custom-developed scales instead of validated instruments. There was frequent misalignment between conceptual definitions and measurement approaches, which makes the results of the studies less reliable and valid, particularly because inconsistent definitions can lead to varying interpretations and applications of engagement metrics across different studies. The dimensions of social and agentic engagement are still not well understood, making up only 12.1% and 7.6% of studies, respectively. The geographic concentration in Asian and North American contexts (77.3%) constrains the generalizability of findings, and more than half of the studies failed to specify the hybrid learning model utilized. These results underscore an imperative for enhanced methodological rigor in engagement research, especially concerning measurement validity and the coherence between conceptual and operational definitions. Subsequent research ought to concentrate on validated instruments, explore engagement across diverse hybrid models and geographic contexts, and analyze emerging dimensions, such as social and agentic engagement, that may hold particular significance in hybrid learning environments.

Declarations

This submission has not been previously published and is not under consideration for publication elsewhere

Ethics approval and consent to participate

Not applicable.

Consent for Publication

All authors have consented to the publication of this manuscript.

Credit authorship contribution statement

Solomon Fobi: Introduction, Methodology, Analysis and Discussion.

Cai Lianyu: Methodology, Analysis, Review and editing.

Availability of Data and Materials

The datasets generated and analyzed during this study are available from the corresponding author upon reasonable request.

Competing Interests

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