MEASURING WHAT MATTERS: A COMPOSITE YOUTH-ENGAGEMENT INDEX AND DATA-DRIVEN MONITORING ARCHITECTURE FOR HIGHER EDUCATION

Ziyoda A. Aripova

Ministry of Higher Education, Science and Innovation of the Republic of Uzbekistan, Tashkent, Uzbekistan

Zafarova Sariya Rustamovna

Bachelor's degree graduate of Tashkent State University of Uzbek Language and Literature

Abstract: *Universities cannot govern student engagement they cannot see. In many rapidly expanding systems, including Uzbekistan's, the management of youth work generates abundant activity but little comparable evidence: participation is counted, satisfaction is occasionally surveyed, yet no single, decomposable measure captures how engaged students actually are.* ***Purpose.*** *This article designs a composite Youth-Engagement Index (YEI) for higher education and embeds it in a practical monitoring architecture, so that engagement becomes a governable quantity rather than an anecdote.* ***Methods.*** *Following the OECD/JRC methodology for constructing composite indicators, the study defines a five-dimensional model of engagement — academic, co-curricular, civic-social, psychological and digital — selects observable sub-indicators for each, and specifies normalization, theory-led weighting, aggregation and robustness testing. The approach is illustrated with data patterns from three higher education institutions in Tashkent.* ***Results.*** *The YEI renders engagement comparable across faculties and cohorts while remaining decomposable into its dimensions, exposing profiles that a single total would conceal; it is paired with an early-warning workflow and a data-governance layer. A comparison with conventional activity counts and one-off surveys shows what a theory-grounded composite adds.* ***Conclusions.*** *A composite index is not a bureaucratic scoreboard but the sensory apparatus of engagement governance: it*

turns scattered digital traces into insight, insight into intervention, and intervention back into measurement. The instrument is transferable to comparable systems and offers a concrete route from monitoring rhetoric to evidence-based practice.

Keywords: *student engagement; composite indicator; youth work; higher education; learning analytics; monitoring; early-warning systems; data governance; Uzbekistan.*

1. Introduction

A recurring finding in the study of youth-work management is that the weakest link is not activity but its measurement. Institutions organise clubs, mentoring, civic projects and digital services in growing number, yet the evidence they collect about the effect of all this remains thin, formal and often subjective. The consequence is a governance blind spot: decisions about where to invest, whom to support and what to change are made without a reliable reading of how engaged students actually are. In systems expanding as quickly as Uzbekistan's — where enrolment has risen from roughly nine to about forty-two per cent of the age cohort within a decade — this blind spot widens precisely as the stakes grow.

The difficulty is partly conceptual and partly technical. Conceptually, engagement is multidimensional: a student may be academically diligent yet civically passive, or digitally active yet psychologically adrift. Reducing this to a single count of events attended flattens exactly the variation that management needs to see. Technically, the digital systems now in daily use — learning management systems, mobile applications, event platforms — generate a stream of behavioural traces, but these traces are rarely assembled into a coherent measure, and when they are, they are seldom validated or governed with the care that behavioural data demand.

This article addresses that gap directly by asking a design question: what would it take to measure youth engagement well enough to govern it? The answer proposed here is a composite Youth-Engagement Index (YEI) — a single, transparent and decomposable score built from weighted sub-indicators across five dimensions, constructed according to the established international methodology for

composite indicators and embedded in a monitoring architecture that closes the loop from data to decision. The paper's contribution is thus threefold: a validated conceptual structure for engagement, a reproducible construction method, and a practical apparatus for turning the resulting scores into targeted, ethically governed action. Throughout, the argument is that measurement is worthwhile only insofar as it changes what institutions do.

2. Literature Review

2.1. Engagement as a multidimensional construct

The scholarly consensus treats student engagement not as a single behaviour but as a family of related states spanning behavioural, emotional and cognitive registers. Influential frameworks locate engagement at the meeting point of the student and the institution, shaped by structural and psychosocial conditions on both sides, and warn against collapsing it into attendance or grades. Empirically, engagement so conceived is linked to a wide range of desirable outcomes — persistence, achievement, satisfaction and well-being — which is why its accurate measurement matters for management and not only for research. The implication for any index is clear: it must be plural, capturing distinct dimensions rather than a single proxy, or it will mislead.

2.2. Learning analytics and its limits

The rise of learning analytics has made large-scale measurement of engagement feasible, allowing institutions to monitor progression, model behaviour and detect risk from data generated in the ordinary course of study. Yet the field has learned humility. Early enthusiasm gave way to the recognition that some analytics correlate poorly with the outcomes they are assumed to predict, that time-on-platform is a weak proxy for learning, and that the behavioural data underpinning analytics raise acute questions of privacy, consent and trust. The lesson is not to abandon measurement but to discipline it: to select indicators for their theoretical meaning, to be explicit about what a metric can and cannot represent, and to govern data deliberately. A composite index is one way to impose that discipline, because it forces choices about dimensions, indicators and weights into the open.

2.3. The methodology of composite indicators

Composite indicators are widely used to render complex, multidimensional phenomena comparable and communicable, from national competitiveness to well-being. The established methodology, codified by the OECD and the Joint Research Centre, sets out a sequence of steps: developing a theoretical framework, selecting indicators, treating and imputing data, normalizing to a common scale, weighting and aggregating according to theory, and testing robustness before dissemination. The literature is candid that no weighting scheme is beyond criticism and that normalization choices materially affect results; the response is transparency and sensitivity analysis rather than false precision. This mature toolkit has been applied across many domains but, notably, not yet to the measurement of youth engagement in higher education — an omission this paper seeks to remedy.

2.4. The missing instrument

Bringing these strands together exposes a specific gap. The engagement literature supplies a rich, multidimensional concept but few operational, institution-level measures; the analytics literature supplies data and computation but limited conceptual structure and uneven governance; the composite-indicator literature supplies a rigorous construction method but has not been turned on this problem. What is absent is a theory-grounded, methodologically disciplined and ethically governed composite measure of youth engagement that a university can actually compute and act upon. The Youth-Engagement Index proposed below is designed precisely to occupy that space.

3. Research Methodology

The study is a design-oriented, conceptual-analytical inquiry: its object is to construct and justify a measurement instrument rather than to test a hypothesis about a population. The construction follows the OECD/JRC ten-step framework, adapted to the setting of youth-work management. Four decisions structure the work. First, the theoretical framework is fixed as the five-dimensional model of engagement set out in Section 4.1, chosen to reflect the multidimensional consensus in the literature and the realities of Uzbek institutions. Second, for each dimension a small set of

observable sub-indicators is selected on grounds of relevance, measurability and availability from systems already in use. Third, a transparent computational scheme — min–max normalization, theory-led weighting and additive aggregation — is specified, together with a robustness check. Fourth, the resulting instrument is illustrated with data patterns drawn from three higher education institutions in Tashkent (denoted HEI-A, HEI-B and HEI-C), the same setting examined in the author's prior work, so that the index can be shown in operation rather than only in the abstract.

Two boundary conditions are stated at the outset. The illustrative figures are indicative rather than authoritative estimates, since the aim is to demonstrate the instrument's logic; and the weighting scheme is offered as a defensible default, not as a final answer, precisely because the methodology treats weights as a matter for transparent, revisable judgement supported by sensitivity analysis.

4. Results and Discussion

4.1. The five dimensions of engagement

The first and foundational result is the conceptual structure of the index, presented in Table 1 and depicted in Figure 1. Five dimensions are distinguished, each answering a different question about how a student is connected to the institution, and each theoretically motivated.

Table 1. The five dimensions of the Youth-Engagement Index and their theoretical basis.

Dimension	What it captures	Theoretical basis
Academic	Involvement in formal learning: attendance, participation, use of learning resources	Behavioural engagement; the core of most engagement frameworks
Co-curricular	Participation in clubs, events, competitions and	Involvement theory; co-curricular participation linked to persistence

	project work beyond the classroom	
Civic & social	Volunteering, social and community projects, self-initiated activity	Service-learning; agency and social responsibility
Psychological	Sense of belonging, motivation and well-being	Belonging research; emotional engagement as a buffer and driver
Digital	Genuine interaction on institutional platforms, beyond passive receipt of notices	Learning analytics; participation, not mere presence

Interpretation. Table 1 does more than list categories; it insures the index against the central error identified in the literature — mistaking one facet of engagement for the whole. Because the psychological dimension sits alongside the behavioural ones, the index can register a student who attends dutifully yet feels no belonging, a pattern that predicts later disengagement and that attendance data alone would miss. The scientific conclusion is that validity here is a matter of coverage: only a plural structure can represent a plural phenomenon. Figure 1 shows the five dimensions organised around the composite they jointly constitute.

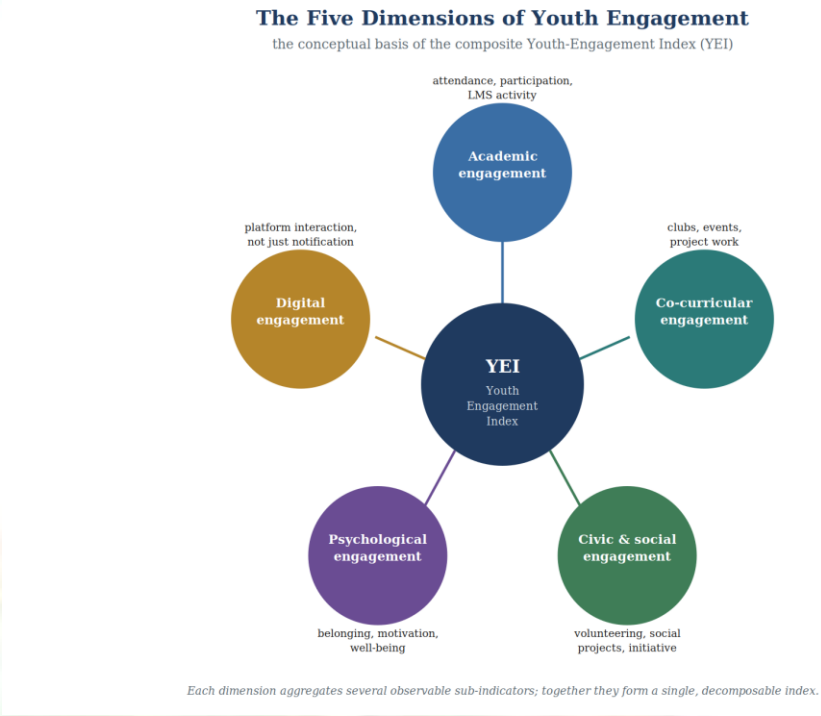

Figure 1. *The five dimensions of youth engagement organised around the composite Youth-Engagement Index; each dimension aggregates several observable sub-indicators.*

4.2. From dimensions to indicators

A conceptual structure becomes measurable only when each dimension is tied to concrete, collectable signals. Table 2 sets out an illustrative indicator taxonomy, deliberately favouring data that institutions can obtain from systems already in operation rather than from new, burdensome instruments.

Table 2. Illustrative indicator taxonomy: example sub-indicators, data sources and measurement types.

Dimension	Example sub-indicators	Primary data source	Type
Academic	Attendance rate; active participation; resource access frequency	LMS logs; timetabling	Behavioural / count
Co-curricular	Club membership; events attended; projects joined	Event and club system	Count / participation

Civic & social	Volunteering hours; social projects; initiatives proposed	Youth-affairs records	Count / self-initiated
Psychological	Belonging; motivation; well-being self-report	Short pulse survey	Scaled / perceptual
Digital	Two-way interactions; content contributed; responses	Platform / mobile app	Behavioural / interaction

Interpretation. Table 2 embodies a governance principle as much as a technical one: measurement should ride on existing data flows wherever possible, reserving new collection (here, a brief perceptual pulse) only for what cannot be observed behaviourally, such as belonging. Mixing behavioural and perceptual signals is deliberate, because the two correct for each other — behaviour without perception risks measuring compliance, perception without behaviour risks measuring mood. The scientific conclusion is that a credible index must be multi-source, and that the psychological dimension in particular cannot be inferred from clicks and must be asked.

4.3. Constructing the index

With dimensions and indicators fixed, the index is assembled through the pipeline shown in Figure 2, which mirrors the internationally established sequence for composite indicators. Raw sub-indicators are first brought to a common 0–100 scale by min–max normalization, so that a percentage attendance and a count of projects can be combined; normalized sub-indicators are then averaged into dimension scores; dimension scores are weighted according to the institution's priorities and summed into the overall YEI; and the whole is subjected to a robustness check that varies the weights to confirm that conclusions do not hinge on any single arbitrary choice.

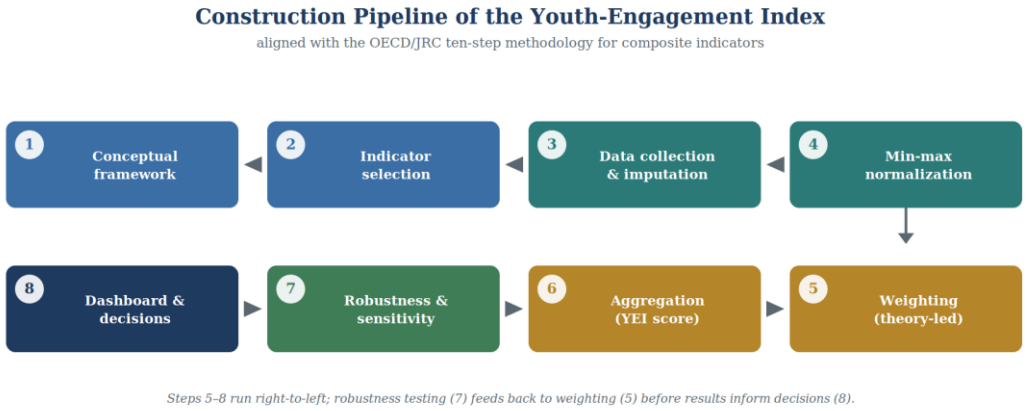

Figure 2. *Construction pipeline of the Youth-Engagement Index, aligned with the OECD/JRC ten-step methodology; robustness testing feeds back to the weighting decision.*

Table 3 illustrates the computation with indicative values for the three institutions. It shows dimension scores, an equal-weight baseline and a priority-weighted variant, making transparent both the arithmetic and the effect of the weighting choice.

Table 3. Illustrative computation of the YEI for three institutions (normalized dimension scores, 0–100).

Institution	Acad.	Co-cur.	Civic	Psych. / Digital	YEI (equal / weighted)
HEI-A	72	64	58	61 / 71	65.2 / 66.4
HEI-B	68	55	46	57 / 68	58.8 / 60.1
HEI-C	63	40	33	49 / 62	49.4 / 51.0

Interpretation. Table 3 demonstrates the instrument's central virtue: it summarises without erasing. The single YEI figure ranks the institutions, but the dimension columns explain the ranking, revealing that HEI-C's lower total is driven by weak civic and co-curricular engagement rather than by digital or academic shortfalls. That the equal-weight and priority-weighted totals differ only modestly is itself reassuring — it indicates that the ranking is robust to the weighting choice, exactly the property the robustness step is meant to confirm. The scientific

conclusion is that a well-built composite is diagnostic, not merely evaluative: it points to where action is needed. Figure 3 renders these profiles as radar charts.

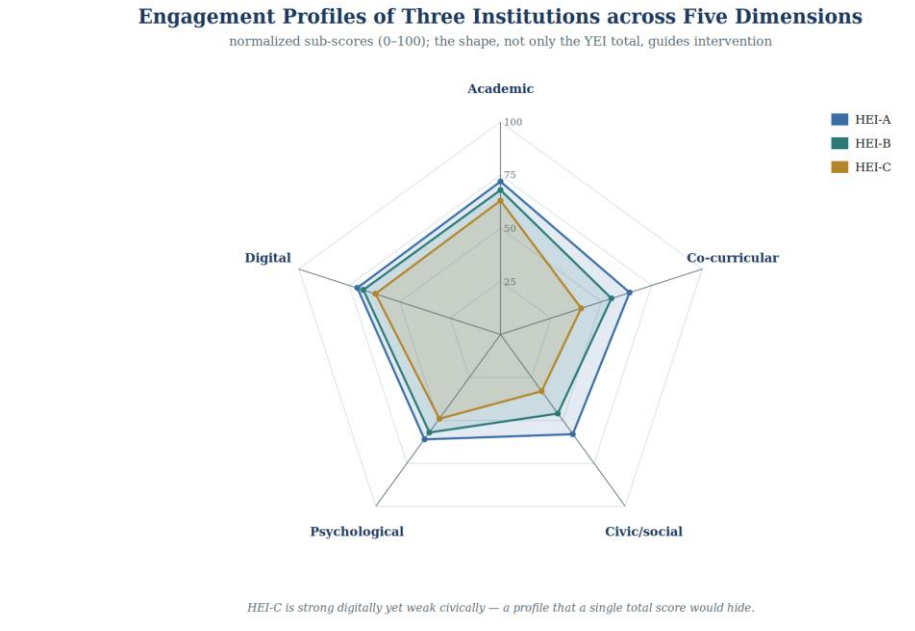

Figure 3. *Engagement profiles of the three institutions across the five dimensions; the shape of each profile, not only the total, guides intervention.*

4.4. What the composite adds

The value of the YEI is clearest when set against the alternatives it is meant to replace. Table 4 compares it with the two approaches most common in practice: raw activity counts and one-off satisfaction surveys.

Table 4. The Youth-Engagement Index compared with conventional measurement approaches.

Property	**Activity counts**	**One-off surveys**	**Youth-Engagement Index**
Coverage	Behaviour only	Perception only	Five dimensions, multi-source
Comparability	Low (raw counts)	Moderate	High (normalized 0–100)
Decomposability	Limited	Limited	Full — down to sub-indicators

Timeliness	Continuous but shallow	Periodic snapshot	Continuous and structured
Actionability	Weak	Weak	Strong — flags where and whom

Interpretation. Table 4 clarifies that the YEI is not simply a fancier count. Its advantages are structural: it covers dimensions the alternatives ignore, it is comparable and decomposable by construction, and above all it is actionable, because a low score can always be traced to a specific dimension, cohort or sub-indicator. The scientific conclusion is that the choice between these approaches is a choice about whether measurement will inform management or merely decorate reports; the composite is the option that does the former.

4.5. From measurement to intervention

An index that is computed but not acted upon changes nothing. The final pair of results therefore concerns the institutional apparatus that turns scores into action. Figure 4 sets out a monitoring architecture in which distributed data sources feed a common data layer and the YEI engine, which in turn drives both a diagnostic dashboard and a set of early-warning triggers routed to the units responsible for response. Figure 5 abstracts the underlying principle as a data-to-decision loop: measure, interpret, decide, act, re-measure.

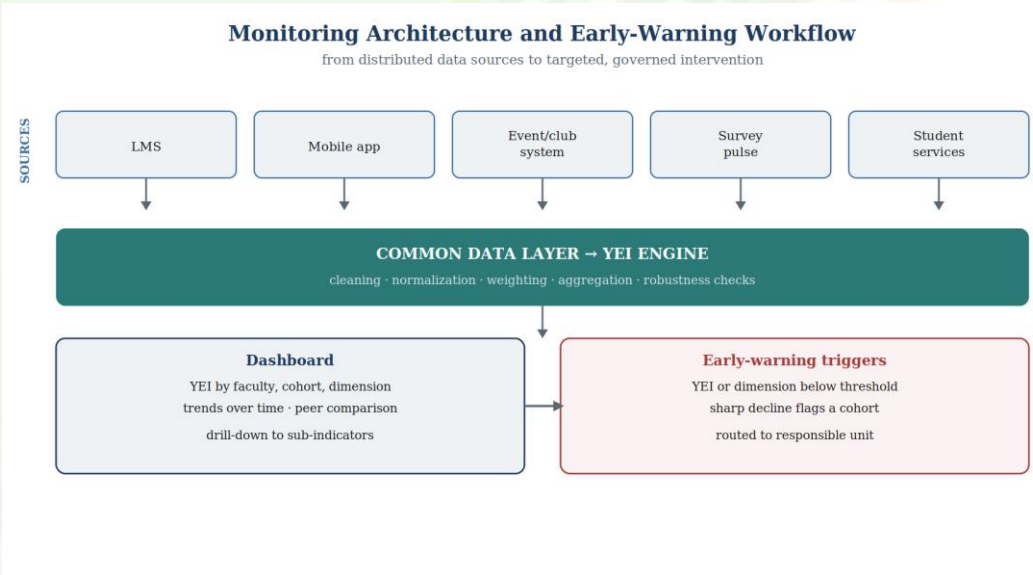

Figure 4. *Monitoring architecture and early-warning workflow: from distributed sources through the YEI engine to dashboards and governed intervention.*

The loop in Figure 5 makes explicit why the earlier steps matter. Normalization and weighting exist so that interpretation is meaningful; the dashboard exists so that decision is informed; and re-measurement exists so that the effect of action is verified rather than assumed. Without the final step the system reverts to the very subjectivity the index was built to overcome.

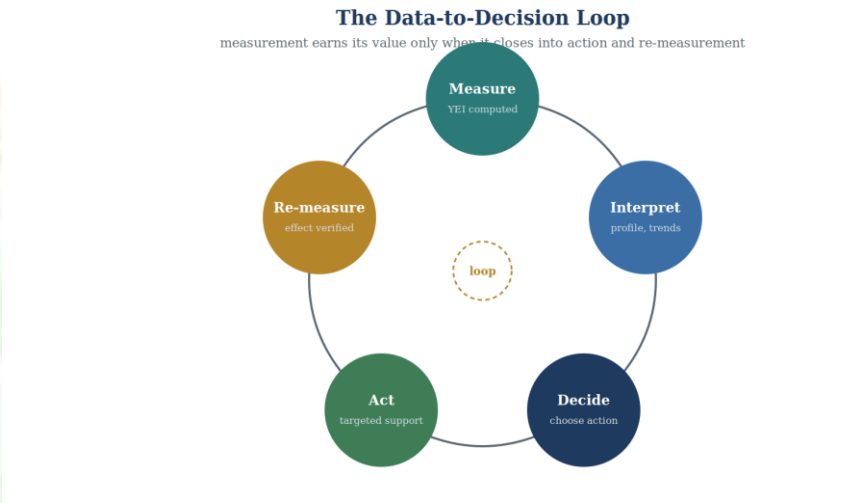

Figure 5. *The data-to-decision loop: measurement earns its value only when it closes into intervention and re-measurement.*

Because the index runs on behavioural data, its legitimacy depends on how that data is handled. Table 5 sets out the governance safeguards that must accompany the instrument, treating ethics not as an afterthought but as a condition of use.

Table 5. Data-governance safeguards for engagement monitoring.

Safeguard	**Requirement**
Purpose limitation	Data collected for engagement support is not repurposed for punitive or unrelated ends
Transparency	Students are informed what is measured, why, and how it is used
Proportionality	Only indicators with clear developmental value are collected; intrusive tracking is avoided

Aggregation by default	Reporting favours cohort-level insight; individual data is accessed only to offer support
Human judgement	Early-warning flags prompt human review, never automated penalties
Review	Indicators, weights and safeguards are audited periodically for fairness and drift

Interpretation. Table 5 completes the instrument by making its use defensible. Each safeguard responds to a documented risk of behavioural analytics — function creep, opacity, over-collection and automated judgement — and together they ensure that monitoring strengthens rather than strains the relationship between students and their institution. The scientific conclusion is that governance is not external to measurement but part of its validity: an index that erodes trust will corrupt the very data it depends on.

5. Conclusions and Recommendations

This article set out to solve a specific, consequential problem: that youth-work management cannot improve what it cannot measure. Its answer is the Youth-Engagement Index — a five-dimensional, theory-grounded, methodologically disciplined composite that renders engagement comparable across an institution while remaining decomposable to the level of a single sub-indicator, and that is embedded in a monitoring architecture closing the loop from data to intervention. The central conclusion is that measurement, done properly, is not a bureaucratic overlay but the sensory system of engagement governance: it converts the digital traces institutions already generate into insight, insight into targeted action, and action into verified effect.

Several recommendations follow for institutions and systems seeking to adopt the instrument.

1. **Start from the five dimensions, not the data.** Fix the conceptual structure first and select indicators to serve it, so that the index measures engagement rather than whatever happens to be easy to count.

2. **Ride existing data flows.** Draw behavioural indicators from systems already in use and reserve new collection for the perceptual signals — above all belonging — that cannot be observed otherwise.

3. **Make weights explicit and test them.** Treat weighting as a transparent institutional judgement, publish it, and confirm through sensitivity analysis that conclusions do not depend on any single arbitrary choice.

4. **Build the loop, not just the score.** Pair the index with a dashboard and early-warning workflow so that low readings reliably trigger human review and support, and re-measure to verify effect.

5. **Govern the data as a condition of use.** Adopt the safeguards of purpose limitation, transparency, proportionality, aggregation by default and human judgement before deploying the index at scale.

6. **Benchmark and iterate.** Compare YEI profiles across faculties and over time, and revise indicators and weights as the institution and its students change.

The instrument's limitations mark the path ahead. The dimensions and weights proposed here are a defensible starting point, not a settled standard; the illustrative values demonstrate logic rather than establish fact; and the psychometric validation of the perceptual sub-indicators, together with a full-scale computation of the YEI across a national system, remains to be carried out. Undertaking that validation, and relating YEI scores to downstream outcomes such as retention and achievement, is the natural continuation of this work. What the present study offers in the meantime is a concrete, transferable way to make youth engagement visible — and therefore governable.

REFERENCES

[1] Aripova, Z. A. (2025). Management technologies for effective youth engagement in higher education institutions. Kokand State Pedagogical Institute Scientific Bulletin, 6, 1046–1051.

[2] Aripova, Z. A. (2024). The current state of management of the system of working with youth in higher education. Proceedings of the International Conference on Scientific Research in Natural and Social Sciences, Toronto.

[3] Gašević, D., Dawson, S., & Siemens, G. (2017). Let's not forget: learning analytics are about learning. TechTrends, 59(1), 64–71.

[4] Greco, S., Ishizaka, A., Tasiou, M., & Torrisi, G. (2019). On the methodological framework of composite indices: a review of weighting, aggregation and robustness. Social Indicators Research, 141, 61–94.

[5] Henrie, C. R., Halverson, L. R., & Graham, C. R. (2018). Measuring student engagement in technology-mediated learning: a review. Computers & Education, 90, 36–53.

[6] Kahu, E. R. (2013). Framing student engagement in higher education. Studies in Higher Education, 38(5), 758–773.

[7] Kahu, E. R., & Nelson, K. (2018). Student engagement in the educational interface. Higher Education Research & Development, 37(1), 58–71.

[8] Macfadyen, L. P., & Dawson, S. (2010). Mining LMS data to develop an early-warning system for educators. Computers & Education, 54(2), 588–599.

[9] Mougiakou, S., et al. (2024). Unpacking student engagement in higher education learning analytics: a systematic review. International Journal of Educational Technology in Higher Education, 21.

[10] Nardo, M., Saisana, M., Saltelli, A., & Tarantola, S. (2005). Tools for composite indicators building. European Commission, Joint Research Centre.

[11] OECD & Joint Research Centre. (2008). Handbook on Constructing Composite Indicators: Methodology and User Guide. Paris: OECD Publishing.

[12] Strayhorn, T. L. (2019). College Students' Sense of Belonging (2nd ed.). New York: Routledge.

[13] Tsai, Y.-S., & Gašević, D. (2017). Learning analytics in higher education: challenges and policies. Proceedings of LAK '17, 233–242.

[14] Veluvali, P., & Surisetti, J. (2022). Learning management systems for student engagement in higher education. Higher Education for the Future, 9(1), 107–121.

[15] President of the Republic of Uzbekistan. (2023). Uzbekistan-2030 Development Strategy. Tashkent.