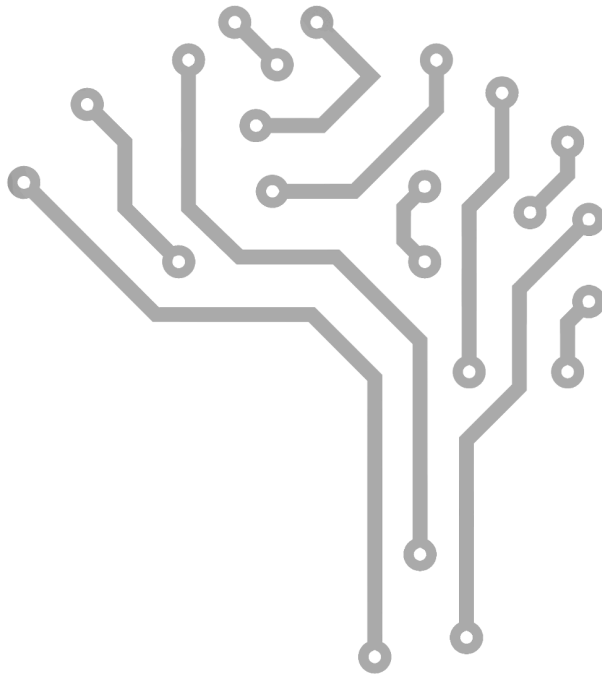


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DELIVERABLE 4.5:

Behaviour impact assessment methodology: guideline and toolkit

Description: Methodological guidelines that also include a toolkit to plan behavioural interventions

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Part 1 - Conceptual Framework

1. Purpose and Scope

1.1 Context and Rationale

As higher education evolves into data-rich, digitally mediated ecosystems, the ability to measure and interpret the impact of *pro-digital behaviours* becomes critical. Intelligent Tutoring Systems (ITS) are now central instruments of academic interaction — mediating assessment, feedback, and learning personalization. Yet, the use of behavioural analytics and adaptive algorithms introduces profound questions about ethics, agency, and equity.

The **Guideline and Toolkit for Behaviour Impact Assessment** provides institutions with an integrated methodology to design, apply, and monitor ethical impact evaluations of student behaviour within ITS environments.

It builds sequentially upon three foundational deliverables:

1. **The Handbook (T4.1):** established the theoretical and ethical foundations — advocating reflexivity, adaptive fidelity, and contextual integrity.
2. **Methodology and Content Framework (T4.3):** defined the psychometric and analytical backbone, using Item Response Theory (IRT) and longitudinal validation to ensure scientific reliability.
3. **Full Psychometric Questionnaire (T4.4 – PDBI):** operationalized constructs into measurable indicators, linking behavioural patterns with ethical and pedagogical dimensions.

Together, these components culminate in this Guideline and Toolkit — a structured pathway from **ethical vision** to **practical implementation**, ensuring that behavioural measurement supports learning, not surveillance.

1.2 Objectives

The Guideline and Toolkit aim to:

- Provide a **transparent, participatory, and scientifically validated methodology** for assessing pro-digital behaviour factors.
- Translate the ethical imperatives of the *Handbook* into **operational standards and tools**.
- Enable institutions to monitor the **impact of digital learning systems** on student engagement, inclusion, and equity.
- Support a **reflexive impact culture**, where measurement continuously informs system improvement and learner empowerment.
- Foster **alignment between pedagogical purpose, data science, and ethical governance**.



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1.3 Audience

The Guideline serves multiple actors within higher education ecosystems:

Stakeholder	Role in the Framework
Educators and Tutors	Use diagnostic rubrics and dashboard insights to interpret data ethically and support personalized feedback.
Students	Contribute to reflective data through surveys and friction logs; co-interpret results via the Ethical Impact Dashboard.
Researchers and Psychometricians	Validate and recalibrate behavioural measures using IRT and longitudinal models.

Institutional Leaders	Embed governance mechanisms (e.g., the Digital Learning Bill of Rights) and ensure fairness in AI-supported education.
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The Toolkit is modular and adaptable: institutions can deploy it as a whole framework or adopt specific components (e.g., the Friction Log, Dashboard, or Rubric) depending on their stage of digital transformation.

2. Ethical and Pedagogical Foundations

2.1 The Shift from Metrics to Meaning

Traditional evaluation paradigms have prioritized quantifiable outcomes — grades, completion rates, and time-on-task. The *Handbook* challenged this model by emphasizing **reflexivity**: the idea that learning impact must be co-defined by learners, educators, and systems.

The Guideline adopts this stance, shifting focus from *what students do* to *how and why they do it*, and how those behaviours are **interpreted, supported, and made visible** within ITS environments.

The assessment of pro-digital behaviour thus becomes a **dialogic process**, not a unilateral measurement. The aim is to use data to stimulate reflection, conversation, and co-design of ethical, personalized learning experiences.



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2.2 Core Principle

The following principles, distilled from the *Handbook on Impact Assessment Methodologies and Tools*, form the ethical compass of the Guideline and Toolkit.

Principle	Meaning	Application in Toolkit
Adaptive Fidelity	Tools maintain conceptual fidelity across contexts while allowing local adaptation.	Questionnaires and dashboards can be linguistically or culturally tailored without losing theoretical coherence.
Contextual Integrity	Every dataset is interpreted in light of students' real conditions — social, cultural, emotional, and infrastructural.	Friction Logs and Diagnostic Rubrics allow tutors and learners to contextualize behavioural data before any intervention.
Reflexivity	Evaluation is iterative and participatory — it invites learners to interpret their own data.	Ethical Impact Dashboard and Reflective Reports let students annotate and contest system-generated insights.

Justice Orientation	Ethical assessment must detect and correct inequities in digital systems.	The Digital Learning Bill of Rights and Equity Audit Panels ensure continuous oversight and fairness in ITS deployment.
Co-Creation	Learners, tutors, and designers collaborate in shaping evaluation frameworks.	Student feedback directly informs algorithmic adjustments, nudging design, and policy revision.

Together, these principles position behaviour impact assessment as a **shared ethical practice**, aligning technological intelligence with human judgment and care.



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2.3 Conceptual Definition: “Pro-Digital Behaviour”

Within this framework, **Pro-Digital Behaviour (PDB)** refers to the adaptive, self-aware, and ethically engaged ways individuals navigate digital learning ecosystems.

It goes beyond technical competence to encompass four interrelated dimensions:

1. **Academic Digital Commitment** – persistence, motivation, and responsibility in digital study environments.
2. **Digital Teaching and Learning Practices** – strategic use of digital tools for learning, collaboration, and knowledge creation.
3. **Digital Self-Efficacy** – confidence in managing digital tools, problem-solving, and customizing learning environments.
4. **Digital Awareness** – critical understanding of data ethics, bias, and the social impact of algorithmic systems.

The *Pro-Digital Behaviour Inventory (PDBI)*, introduced in T4.4, measures these constructs both quantitatively and qualitatively — ensuring that each response reflects not just behaviour, but its **meaning, context, and intention**.

3. Theory of Change: From Behaviour to Impact

3.1 The Logic of Behavioural Impact

Behavioural impact assessment begins with the assumption that **digital engagement is not neutral** — it is shaped by system design, institutional policies, and individual agency.

Hence, the goal is not to label or rank students, but to trace how specific behavioural patterns lead to meaningful educational and ethical outcomes.

Theory of Change Pathway:

Level	Description	Example Indicators
Input	Digital learning contexts and ITS tools (platform features, dashboards, nudges)	AI tutor feedback, engagement analytics
Behaviour	Observable and self-reported pro-digital behaviours	Goal-setting, ethical resistance, temporal orchestration
Intermediate Outcome	Cognitive, emotional, and ethical growth	Increased self-efficacy, improved agency, reflective use of technology
Impact	Sustainable learning cultures and equitable digital ecosystems	Reduced bias in flagging, improved retention, student empowerment

This framework treats behaviour as transformational, not transactional. Measurement is used to facilitate *learning about learning* — both for the student and for the system itself.



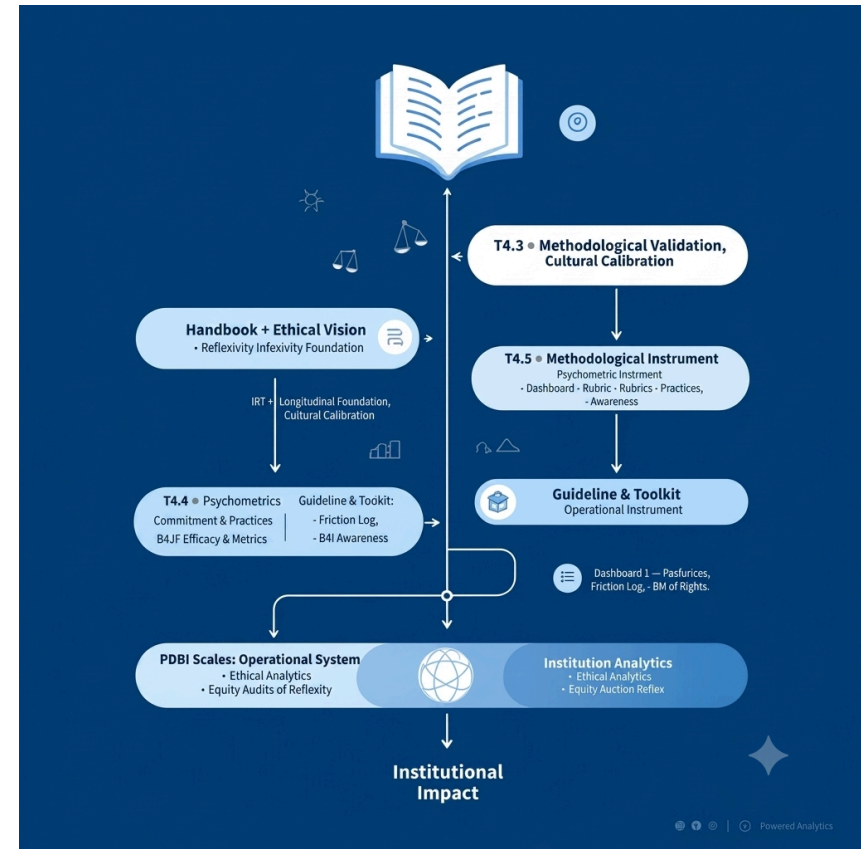
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3.2 Reflexive Impact Culture

The end goal is to establish what the Handbook terms a Reflexive Impact Culture:

- One where students are not passive data sources but active co-analysts of their learning journeys.
- Where tutors interpret dashboards with ethical sensitivity rather than administrative compliance.
- Where institutions regard equity audits and algorithmic transparency not as obligations but as pedagogical assets.

This culture transforms ITS from evaluative machines into living laboratories of learning justice — continuously improved through feedback, contestation, and co-design.



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3.4 Expected Outcomes of Implementation

- Institutions adopting the Behaviour Impact Assessment Guideline and Toolkit can expect to achieve:
- Improved ethical transparency in how learning data are used and interpreted.
- More accurate, bias-aware behavioural evaluation through scientifically validated instruments.
- Enhanced student agency, as learners gain tools to reflect, annotate, and contest automated classifications.
- Institutional equity insights, identifying systemic disparities across learner demographics.
- Dynamic learning ecosystems that evolve based on human feedback, not static performance metrics.

Part I conclusions

This conceptual framework situates the Guideline and Toolkit within the broader transformation of educational impact assessment.

By linking ethics, psychometrics, and participatory design, it ensures that Intelligent Tutoring Systems — and the institutions that deploy them — remain accountable to the principles of justice, transparency, and human dignity.

The following section (Part II) builds on this foundation to detail the Methodological Framework, outlining the specific analytical models, constructs, and processes that make behavioural impact assessment reliable, adaptive, and fair.

Part II - Methodological Framework

4. Design Principles and Methodological Logic

4.1 From Concept to Method

The methodological framework operationalizes the ethical imperatives of the Handbook — reflexivity, contextual integrity, and adaptive fidelity — through psychometric and analytical design.

It ensures that every measure of behaviour is not only statistically valid but also ethically meaningful and pedagogically interpretable.

This approach combines:

- Quantitative precision (via Item Response Theory and longitudinal modelling)
- Qualitative reflexivity (via friction logs and contextual rubrics)
- Ethical calibration (through fairness audits and participatory review cycles)

In doing so, the Guideline shifts educational analytics from being predictive to reflective — using data not to pre-judge students, but to help institutions learn about the learning process itself.



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4.2 Methodological Continuity: From T4.3 to the Toolkit

Source	Contribution	Continuation in the Toolkit
T4.3: Methodology & Content Framework	Introduced psychometric validation procedures: reliability, validity, IRT calibration, longitudinal linking, DIF testing.	Underpins the statistical layer of the PDBI, Hybrid Survey, and Equity Dashboard.
T4.4: Pro-Digital Behaviour Inventory (PDBI)	Developed validated item pool (37 items across 4 scales), with cross-cultural fairness checks and adaptive fidelity principles.	Serves as the measurement core of this Guideline; the Toolkit builds interpretation and feedback tools around it.
Toolkit (Ethical Instruments)	Extends methodology into reflexive, user-facing applications (dashboard, rubric, friction log, Bill of Rights).	Operationalizes the data–ethics–pedagogy triad at institutional and student levels.

This ensures methodological coherence across all deliverables, creating a self-correcting, ethically grounded measurement ecosystem.

5. Construct Map: The Four Dimensions of Pro-Digital Behaviour

The Behaviour Impact Framework identifies **four interrelated constructs**, each validated through psychometric and participatory testing in T4.4. These constructs capture both *what students do* and *how they think and feel* about their interaction with digital systems.

Dimension	Definition	Example Indicators	Primary Instruments
Academic Digital Commitment	Persistence, motivation, and responsibility in digital learning environments.	Task completion consistency, self-reported goal alignment, reflective persistence under technical challenge.	PDBI Section A, Dashboard engagement metrics
Digital Teaching/Learning Practices	Strategic and critical use of digital tools for collaboration and knowledge-building.	Combining resources, peer exchange, adaptive tool use.	PDBI Section B, Tutor Diagnostic Rubric
Digital Self-Efficacy	Confidence in using, troubleshooting, and customizing digital environments.	Confidence in solving technical problems, navigation autonomy.	PDBI Section C, Student Survey



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Digital Awareness	Ethical reflection and critical understanding of algorithmic processes and data governance.	Awareness of bias, consent, and transparency.	PDBI Section D, Friction Log, Bill of Rights audit
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Each construct is designed to be **developmental**, allowing institutions to measure change over time rather than static performance.

5.1 Measurement Philosophy: Beyond Static Metrics

Traditional learning analytics often capture activity, not understanding.

The PDBI and its complementary tools are designed to measure intentional behaviour — interpreting patterns as signals of agency and adaptation rather than compliance.

For example:

- A student with “low login frequency” but high reflective essay scores might be demonstrating offline synthesis rather than disengagement.

- A student who contests an automated alert through the Friction Log is displaying ethical agency, a positive behavioural indicator rather than a disruption.

This interpretive flexibility reflects the Handbook’s principle of adaptive fidelity: fidelity to purpose, not uniformity of form.

6. Analytical Architecture

6.1 Measurement Model: Item Response Theory (IRT)

Item Response Theory (IRT) provides the psychometric foundation for the Behaviour Impact Assessment.

It models the probability that a respondent with a certain level of a latent trait (e.g., digital self-efficacy) will endorse or agree with a given item.

The Graded Response Model (GRM) — used in T4.4 — is particularly suited for Likert-scale items and cross-cultural adaptation.

It enables precision across the full range of ability levels and supports adaptive testing.

Key Parameters:

- Item difficulty (b): how challenging an item is to endorse.
- Item discrimination (a): how well an item distinguishes between respondents with different levels of the trait.
- Information function: how precisely each item measures across ability ranges.



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These parameters ensure that the PDBI and related surveys maintain high reliability and fairness across multiple contexts.

6.2 Validation Process (as defined in T4.3 and updated for Toolkit)

The validation process consists of **six iterative steps**:

Step	Procedure	Key Output
1. Data Preparation	Minimum 200 participants per country; balanced samples by role, gender, and discipline. Missing data handled through Full Information Maximum Likelihood (FIML).	Clean, representative dataset for analysis.
2. Model Selection	Compare Rasch (1PL), 2PL, and GRM models using AIC/BIC.	Select best-fitting model ensuring parsimony and interpretability.
3. Fit Evaluation	Check infit/outfit (0.7–1.3), unidimensionality (CFA: CFI>0.90, RMSEA<0.08), and local independence.	Validated construct structure.
4. Differential Item	Test fairness across groups (gender, language, role, country) using lordif or logistic regression methods.	Bias detection and correction.

Functioning (DIF)		
5. Test Information Function (TIF)	Evaluate where instrument precision is highest (θ range -2 to +2).	Ensure balanced accuracy across ability levels.
6. Longitudinal Linking	Anchor items ensure comparability across waves (T0, T1, T2).	Enables growth modelling and temporal analysis.

This process guarantees methodological robustness while remaining ethically grounded — in line with the **Handbook's reflexive ethics** and **T4.3's technical precision**.



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6.3 Longitudinal Validation Framework

Behavioural impact evolves over time; thus, static snapshots are insufficient.

A Longitudinal Validation Framework (LVF) — introduced in T4.3 and embedded here — models change using:

- Latent Growth Models (LGM): estimate trajectories of individual development (e.g., improvement in self-efficacy).
- Growth Mixture Models (GMM): detect subgroups (e.g., “recoverers,” “steady performers,” “decliners”).
- State-space models: dynamically re-weight new data so early errors do not permanently define a learner’s trajectory (preventing epistemic freezing).

Example Use:

A university tracks PDBI scores over two semesters. Initial “low engagement” students later show improvement. The LGM identifies positive slopes; algorithmic models recalibrate accordingly. This dynamic validation ensures the system learns from learner growth, not just from historical patterns.

6.4 Qualitative Integration and Reflexive Analytics

While psychometrics offer precision, **interpretive depth** is achieved through qualitative tools.

The Guideline introduces **reflexive analytics**, a method that integrates behavioural data with narrative context.

Data Source	Function	Output
Friction Logs	Capture lived experiences of nudges, stress, and system misalignment.	Thematic maps of emotional and contextual friction.
Tutor Diagnostic Rubric	Provides human interpretation of student behaviours.	Narrative annotations within ITS records.
Student Surveys (open-ended sections)	Allow learners to describe invisible learning and ethical reflection.	Context-rich insights for model retraining.

This integration transforms analytics into **dialogue** — turning numbers into stories that guide system adaptation and policy refinement.

7. Behaviour Impact Assessment Cycle

7.1 Overview

The Behaviour Impact Assessment Cycle (BIAC) provides a structured process for applying the methodology across institutions.

It ensures that ethical and statistical rigor are applied at every stage — from planning to governance.



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Phase	Description	Key Tools	Outputs
1. Planning & Contextual Adaptation	Define local context, select relevant instruments, align with Bill of Rights.	Handbook principles, PDBI, Equity Dashboard	Ethical assessment design plan
2. Measurement & Data Collection	Administer PDBI, Hybrid Survey, and Friction Logs.	Surveys, Logs, Rubrics	Validated datasets
3. Validation & Analysis	Apply IRT, DIF, and longitudinal models.	IRT software (R/mirt, Python/pyIRT)	Psychometric validation reports
4. Reflexive Interpretation	Tutors and students co-analyze dashboard data.	Diagnostic Rubric, Ethical Dashboard	Contextualized insights
5. Action & Feedback	Adjust ITS models and learning design based on findings.	Dashboard alerts, Friction summary reports	Revised system parameters
6. Governance & Review	Annual audit and public reporting of equity indicators.	Bill of Rights, Institutional Review Board	Transparency reports, ethical compliance record

7.2 Data Flow and Human Oversight

A core innovation of this methodology is its **Human-in-the-Loop** design:

- Every algorithmic classification is open to tutor annotation.
- Every student has the right to contest or contextualize their data.
- Every institutional decision is accompanied by traceable ethical documentation.

This ensures that **accountability and interpretation** remain distributed, reinforcing the *Handbook's call for reflexive impact cultures*.



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8. Ethical Safeguards in Methodological Practice

The Guideline embeds ethics directly into data and validation procedures. The following safeguards must be applied at all stages:

Ethical Concern	Safeguard Mechanism	Implementation Tool
Data consent and autonomy	Informed consent and opt-out features before data collection.	Bill of Rights, Consent Manager (Dashboard)
Cultural and linguistic fairness	Cross-group DIF testing and contextual review.	PDBI validation protocol
Bias and discrimination	Continuous equity audits and algorithmic re-weighting.	Ethical Impact Dashboard
Epistemic freezing (fixed labels)	Longitudinal revalidation and temporal re-weighting.	Growth Models, Dashboard
Transparency and accountability	Public model cards and annual reporting.	Institutional Equity Report

Human oversight	Required tutor review for all automated flags.	Diagnostic Rubric, Friction Log
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Ethics here is not post-hoc compliance — it is a constitutive part of the measurement architecture.

9. Outcome Interpretation and Reporting

The Behaviour Impact methodology translates psychometric results into reflexive, actionable insights.

Instead of static scores, it provides profile-based interpretation using both quantitative and qualitative indicators.

Output Type	Audience	Interpretation Mode
Student Report	Learner	Narrative visualization of progress, annotated with self-reflection prompts.
Tutor Dashboard	Educator	Equity heatmaps, rubric-based overrides, and feedback annotation tools.
Institutional Review	Administrators	Aggregated impact analytics: distribution of PDBI scores, DIF alerts, friction clusters.



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Public Transparency Report	Stakeholders	High-level equity and ethical performance indicators (flag ratios, intervention effects).
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Part II conclusions

The Methodological Framework transforms impact assessment from a technical exercise into a moral and pedagogical practice. By combining psychometric precision with participatory ethics, it ensures that data not only describe behaviour but illuminate meaning and guide transformation.

The next section (Part III) will introduce the Toolkit Components and Operational Guidance, detailing each tool's purpose, application process, and alignment with the Behaviour Impact Assessment Cycle.

Part III - Toolkit Components and Operational Guidance

Cross-Tool Integration

Toolkit Layer	Instruments Included	Function in Assessment Cycle	Key Outcome
Measurement Layer	PDBI, Hybrid Survey	Quantify pro-digital behaviours	Reliable, comparable scores

Interpretive Layer	Diagnostic Rubric, Tutor Annotations	Add contextual meaning to data	Ethical judgment and co-interpretation
Feedback Layer	Friction Log, Student Survey	Capture experience and emotional impact	System re-design insights
Governance Layer	Ethical Impact Dashboard, Bill of Rights	Ensure transparency and accountability	Institutional equity and trust

Operational Good Practices

Area	Recommendation	Benefit
Sampling Design	≥ 100 responses per country/site; balance by role and gender.	Stable IRT estimates and cross-cultural validity.
Data Security	Store survey data on encrypted servers with role-based access.	Compliance with GDPR / ethical standards.
Tutor Training	Annual workshops on rubric use and dashboard interpretation.	Builds ethical literacy and



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		reduces automation bias.
Student Engagement	Embed micro-reflections and feedback prompts in ITS.	Maintains agency and participation.
Continuous Validation	Re-run IRT and equity tests each academic year.	Prevents model drift and epistemic freezing.

Part III conclusions

The Toolkit transforms ethical concepts and statistical frameworks into living educational practices.

Each instrument — from dashboards to surveys — is both a measurement device and an ethical safeguard, ensuring that impact assessment in ITS environments remains transparent, inclusive, and co-created.

Part IV will now detail Implementation Guidelines, outlining the step-by-step institutional process, stakeholder roles, and quality-assurance mechanisms that support sustainable deployment of this Toolkit.

Part IV - Implementation Guidelines

Phase 1: Ethical Grounding and Preparation

Objective:

Create institutional readiness for ethical, transparent, and participatory deployment of Behaviour Impact Assessment.

Action	Responsible Actors	Key Deliverables
Adopt the Digital Learning Bill of Rights	Institutional Leadership, Legal & Ethics Boards	Official endorsement, inclusion in policy manuals.
Configure the Ethical Impact Dashboard	IT & Analytics Teams, Tutors, Student Reps	Dashboard installed and configured to display consent, equity, and flagging logic.
Conduct Orientation Workshops	Project Lead / Quality Unit	Training for tutors and staff on ethics, data literacy, and rubric use.
Establish Oversight Structures	Ethics Committee, Student Oversight Board	Defined workflow for equity audits and human-in-the-loop decision reviews

Output:

An *ethical baseline* ensuring that all subsequent data collection operates within agreed rights and responsibilities.



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Phase 2: Measurement Setup and Data Collection

Objective:

Administer validated instruments to capture both behavioural data and contextual experiences.

Action	Responsible Actors	Tools Used
Select Survey Instruments	Research Team / Evaluation Unit	PDBI + Hybrid Survey
Deploy Surveys in ITS Platforms	System Administrators & Tutors	Embedded consent forms; anonymized responses.
Gather Contextual Data	Tutors, Students	Friction Log entries, Diagnostic Rubric annotations.
Ensure Sampling Integrity	Researchers / Data Analysts	Balanced participation ($\geq$ 200 responses per site).

Output:

Clean, ethically sourced datasets combining quantitative (PDBI) and qualitative (Friction Logs, Rubric Notes) evidence.

Phase 3: Validation and Analysis

Objective:

Ensure measurement precision, fairness, and cultural validity before interpretation.

Action	Method	Expected Outcome
Reliability Testing	Cronbach's $\alpha > 0.7$; IRT fit indices	Internal consistency confirmed.
Bias Detection	DIF analysis across gender, language, role	Biased items identified and revised.
Longitudinal Linking	Anchor items + concurrent calibration	Comparable scores across semesters.
Ethical Audit	Dashboard Equity Panel review	Equity and transparency verified.

Output:

Validated behavioural dataset ready for pedagogical interpretation and policy use.

Phase 4: Reflexive Interpretation and Action

Objective:

Translate validated data into understanding and improvement actions.

Action	Participants	Supporting Tools
Tutor Analysis Sessions	Tutors + Advisors	Diagnostic Rubric + Dashboard views
Student Reflection Sessions	Students + Tutors	Personal reports + Friction Logs
Cross-Interpretation Workshops	Mixed teams	Equity Audit Panels + Feedback Reports
Action Plans for Support	Academic Departments	Intervention and co-design initiatives



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Output:

Mutual interpretation of results; recommendations for both learner support and system redesign.

Phase 5 — System Feedback and Recalibration

Objective:

Use insights to recalibrate ITS algorithms and institutional practices.

Action	Responsible Actors	Expected Change
Algorithmic Re-training	Data Science Team + Ethics Board	Adjust weights, nudge phrasing, thresholds.
Curricular Adaptation	Faculty Leads + Tutors	Integrate digital ethics modules or dashboard literacy tasks.
Equity Adjustments	Institutional Analysts	Modify intervention rules to reduce flag disparities.
Documentation	Quality Assurance Unit	Update model cards and ethical impact records.

Output:

Adaptive, self-correcting ITS models and pedagogical designs aligned with justice and context.

Phase 6 — Governance and Annual Review

Objective:

Embed long-term oversight and accountability.

Action	Frequency	Deliverables
Annual Equity Audit	Once per year	Report to governing bodies and students.
Transparency Report Publication	Annually	Public summary of model changes and bias mitigation.
Bill of Rights Review	Biennially	Participatory update of ethical principles.
Re-validation Cycle	Each academic year	New IRT/DIF testing and longitudinal linking.

Output:

A living, self-evaluating governance cycle ensuring continued ethical performance and measurement reliability.



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10. Stakeholder Roles and Responsibilities

Stakeholder	Core Responsibilities	Tools Engaged	Key Competencies Needed
Students	Provide feedback (Friction Logs, Surveys); interpret own data; participate in co-design.	Friction Log, Student Survey, Dashboard	Digital literacy, self-reflection, ethical awareness.
Tutors / Educators	Apply Diagnostic Rubric; mediate alerts; support student interpretation.	Rubric, Dashboard	Pedagogical judgment, data ethics literacy.
Researchers / Data Analysts	Validate data (IRT, DIF, LGM); report results.	PDBI, Hybrid Survey datasets	Psychometrics, statistical modeling.
Institutional Leaders / Quality Units	Enforce governance; publish annual reports; fund training.	Bill of Rights, Ethical Dashboard	Strategic management, equity leadership.
ITS Designers / Developers	Incorporate ethical feedback into system logic;	Dashboard, Friction Log datasets	Human-centered design, responsible AI development.

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Guideline:

Each institution should formalize these roles through Memoranda of Understanding (MoUs) or digital-ethics policy documents.

11. Quality Assurance and Evaluation

11.1 Statistical and Psychometric Standards

Metric	Threshold	Purpose
Cronbach's α	≥ 0.70	Reliability of subscales
Model Fit (CFI / RMSEA)	CFI > 0.90, RMSEA < 0.08	Construct validity
DIF ΔR^2	< 0.02 between groups	Cultural fairness
Information Function	> 0.8 within $\theta = -2$ to +2	Measurement precision
Longitudinal Retention Rate	≥ 70 % of baseline sample	Temporal comparability



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11.2 Ethical and Procedural Standards

Dimension	Standard	Verification Method
Informed Consent	Clear opt-in/opt-out options.	Dashboard consent records.
Data Protection	GDPR compliant storage; role-based access.	IT security audit.
Transparency	Model cards published online.	Annual equity report.
Human Oversight	Mandatory tutor review for automated flags.	Audit log sampling.
Equity	Yearly bias testing and corrective actions.	Equity Audit Panel minutes.

11.3 Evaluation Metrics for Toolkit Effectiveness

Institutions should evaluate not only student outcomes but also how ethically and effectively the Toolkit itself operates.

Indicator Type	Example Metric	Data Source
Learning Effectiveness	↑ in PDBI scores over time	IRT growth models
Equity Impact	↓ in disparity of risk flags across groups	Dashboard audit
Student Agency	% of students using Friction Logs / Dashboard annotations	Log analytics
Tutor Engagement	# of rubric overrides and contextual notes per semester	Tutor dashboard
Transparency Compliance	Publication of annual report & model cards	Institutional website
Satisfaction & Trust	≥ 80 % positive feedback on ethical transparency	End-of-year survey



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12 Continuous Improvement and Capacity Building

12.1 Professional development

- **Tutor Training:** Annual seminars on ethical analytics and dashboard interpretation.
- **Research Workshops:** Sessions on psychometric modeling and longitudinal validation.
- **Student Digital Citizenship Programs:** Modules on data rights and algorithmic awareness.

12.2 Participatory Review Mechanisms

- **friction Log Forums:** Quarterly review of aggregated entries with student representatives.
- **Ethical Reflection Panels:** Tutor-student dialogues on misclassifications and bias.
- **Design Jams:** Collaborative workshops where ITS developers co-create solutions to identified issues.

12.3 Institutional Learning Cycle



Each cycle feeds into the next academic year, ensuring a learning ecosystem that improves through feedback and accountability.



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13. Risk Management and Mitigation

Risk	Potential Impact	Mitigation Strategy
Low Student Participation	Incomplete data and biased results.	Incentivize participation through dashboard credits or recognition.
Data Overload for Tutors	Alert fatigue and reduced engagement.	Dashboard filtering and alert prioritization.
Algorithmic Drift	Inequitable outputs over time.	Scheduled recalibration and fairness testing.
Ethical Non-Compliance	Institutional reputation risk.	Mandatory ethics audits and external review panels.
Cultural Misalignment	Misinterpretation of behaviours.	Localization of rubrics and survey language via focus groups.

14. Implementation Timeline Template

Month	Key Activity	Deliverables
1–2	Ethical grounding & training	Bill of Rights adopted, dashboard installed.
3–5	Data collection phase	Surveys and Friction Logs completed.
6–7	Validation & analysis	IRT/DIF reports + equity review.
8	Reflexive interpretation workshops	Student & tutor feedback summary.
9–10	Recalibration and policy update	Adjusted ITS parameters + curricular recommendations.
11–12	Annual governance review	Transparency Report & Audit published.

Part IV conclusions

Implementation is where the ethical vision of the Handbook and the scientific rigour of T4.3 and T4.4 converge into practice. By following this step-by-step roadmap, institutions can build a living impact ecosystem — one that continuously learns, corrects, and evolves toward greater justice, transparency, and educational intelligence. Part V will now focus on Governance and Sustainability, describing how the Bill of Rights, audit mechanisms, and capacity building consolidate the long-term ethical governance of Behaviour Impact Assessment.



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Part V -Governance and Sustainability

15.Embedding the Digital Learning Bill of Rights

15.1 Purpose and Legal Standing

The *Digital Learning Bill of Rights* (DLBoR) is the cornerstone of ethical governance in digital education. It provides a legal-ethical framework that protects learners' autonomy and ensures transparency in Intelligent Tutoring System (ITS) operations.

Institutions adopting the BIA Toolkit must formally integrate the DLBoR into:

- Academic regulations and digital-learning policies;
- Student charters and data-privacy statements;
- Staff codes of conduct and algorithmic-governance protocols.

15.2 Operationalization Matrix

DLBoR Right	Implementation Mechanism	Verification Tool
Data Consent and Privacy	Dashboard consent manager + opt-out options for non-essential tracking.	Annual privacy compliance audit.
Human Oversight and Contestability	Friction Log + human-review queue for algorithmic alerts.	Tutor-override log; equity panel records.
Participatory Design	Co-creation workshops for feedback on nudging logic and dashboard usability.	Meeting minutes; design-revision changelog.
Algorithmic Transparency	Public model cards explaining data inputs, weights, and confidence intervals.	Institutional transparency report.
Digital Dignity and Context Recognition	Rubric annotations and contextual tagging for offline realities.	Dashboard contextual-integrity summary.
Equity Protection	Yearly Differential Item Functioning (DIF) and bias audits.	Equity-Audit Panel report.



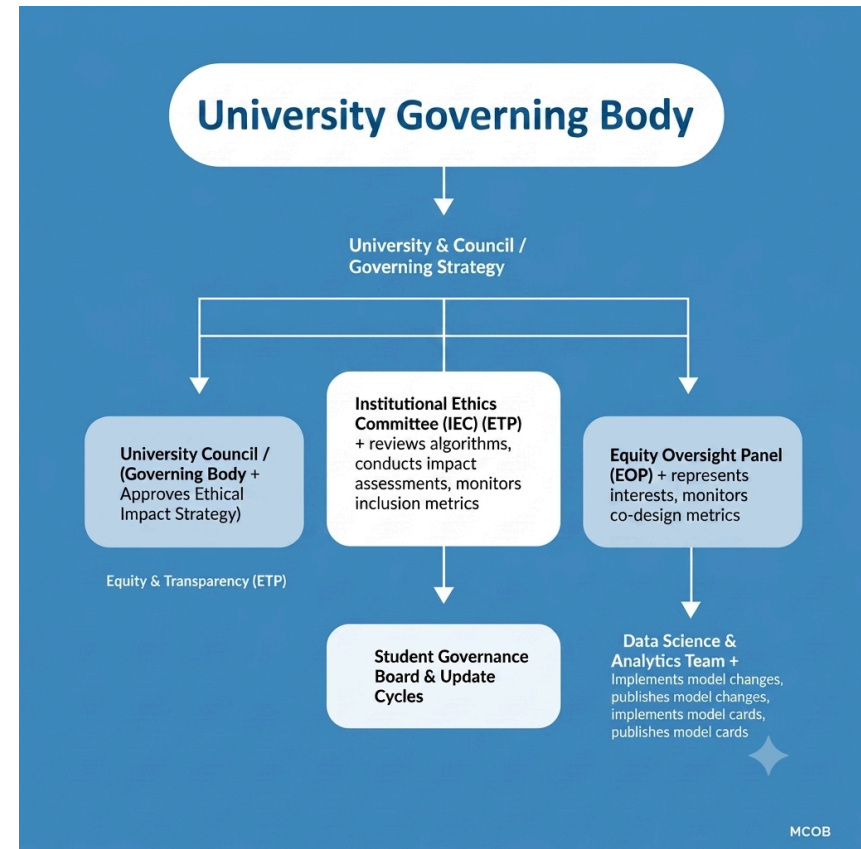
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15.3 Enforcement and Accountability

1. **Institutional Ethics Committee (IEC):**
Oversees compliance, reviews contestations, and signs off transparency reports.
2. **Student Oversight Board (SOB):**
Holds deliberative power to request audits, propose design changes, and co-approve annual DLBoR updates.
3. **Data Protection Officer (DPO):**
Ensures legal compliance with GDPR and institutional data-governance frameworks.
4. **Public Reporting Obligation:**
All participating institutions publish an *Annual Ethical Impact Statement* summarizing model revisions, audit outcomes, and student feedback.

16. Ethical Governance Architecture

16.1 Multi-Layer Oversight Structure



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16.2 Decision-making Workflow

1. **Detection:** Dashboard or audit identifies an ethical or statistical anomaly.
2. **Review:** Tutor or analyst logs issue to IEC.
3. **Evaluation:** ETP analyses evidence and recommends corrective action.
4. **Consultation:** SOB reviews recommendations from a learner-centric perspective.
5. **Decision:** University Council ratifies change and updates policy registry.

This ensures transparency, inclusion, and shared accountability across governance tiers.

17. Transparency and Equity Audits

17.1 Annual Transparency Report

Each institution produces a concise public report that includes:

- Overview of ITS models and key algorithmic parameters;
- Summary of equity and fairness indicators;
- Updates to the Bill of Rights;
- Results of tutor-student participatory audits;
- List of significant algorithmic or policy modifications.

Format Recommendation:

Four-page PDF summary with infographics + QR link to detailed data annex.

17.2 Equity Audit Procedures

Step	Description	Responsible Body	Frequency
1. Data Compilation	Aggregate performance, engagement, and flagging data by demographic categories.	Analytics Team	Each semester
2. Bias Detection	Run statistical parity, DIF, and flag-ratio analysis.	ETP	Each semester
3. Qualitative Triangulation	Review friction logs and student feedback for contextual patterns.	SOB + Tutors	Annually
4. Action Plan	Identify causes and propose remediation.	IEC + Council	Annually
5. Follow-Up Validation	Assess post-intervention effects.	Analytics Team	Next cycle



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17.3 Equity Scorecard

An internal dashboard summarizing progress across dimensions:

- Gender parity index in system alerts
- Cross-cultural DIF score < 0.02
- Equity in engagement (time-on-task variance < 10 %)
- Student trust index (≥ 80 % positive feedback on transparency)

18. Sustainability Strategy

18.1 Institutionalization of Practices

To sustain ethical impact beyond the project lifecycle:

- Integrate the BIA Toolkit into annual quality-assurance cycles.
- Include ethical-analytics performance in staff appraisals and accreditation reviews.
- Establish a recurring **Ethical Innovation Fund** to support pilot improvements.

18.2 Long-Term Data Stewardship

- Store anonymized datasets under a five-year retention policy.
- Require that model retraining logs and decisions be version-controlled.

- Maintain a *Knowledge Repository* documenting case studies and lessons learned.

18.3 Financial and Human Resources Planning

Resource Area	Recommended Investment	Sustainability Impact
Training	1 % of annual ITS budget for ongoing ethics & data-literacy training.	Maintains capacity and reduces bias.
Infrastructure	Cloud-based secure analytics environment with explainability APIs.	Scalable and compliant data management.
Community Engagement	Annual ethics-in-education summit hosted by the institution.	Strengthens participatory culture and visibility.

19. Participatory Governance and Community Building

19.1 Student and Staff Co-Creation

Encourage participatory design through:

- **Student Ethics Ambassadors** programs;
- **Tutor-Learner Reflection Circles** for shared analysis;



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- **Hackathon Challenges** to redesign nudging systems ethically.

19.2 External Partnerships

Form alliances with:

- National agencies for AI in education;
- NGOs focused on digital rights;
- EdTech companies for open-source ethical modules.

Such partnerships extend the sustainability of the Toolkit beyond a single institution.

19.3 Open Data and Knowledge-Sharing

- Publish de-identified datasets for comparative research.
- Contribute to international benchmarks on ethical ITS practices.
- Create an *Open Toolkit Repository* with templates, dashboards, and code snippets.

20. Capacity Building for Sustainable Change

Capacity Area	Target Audience	Activity Type	Outcome
Ethical Analytics Literacy	Tutors, Students	Online micro-courses	Informed decision-making about data use.
Psychometric Competence	Researchers	Advanced workshops on IRT & DIF	Local validation and adaptation capacity.
Policy Governance	Leadership Teams	Executive seminars	Ability to align ethics with strategy.
Design Thinking for Equity	Developers, UX teams	Co-design labs	Inclusive system design practices.



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21. Monitoring and Evaluation Framework (M&E)

21.1 Key Performance Indicators

Domain	Indicator	Data Source	Review Cycle
Ethical Compliance	% of algorithms with published model cards	Transparency Report	Annual
Fairness	Avg. cross-group bias (DIF $\Delta R^2 < 0.02$)	Equity Audit Dataset	Semesterly
Student Agency	% of learners submitting Friction Logs or dashboard annotations	Dashboard Analytics	Quarterly
Tutor Participation	# of rubric annotations per semester	Tutor Log	Semesterly
Governance Engagement	# of Student Oversight Board sessions	Governance Calendar	Annual

21.2 Continuous-Improvement Loop

1. **Collect:** Data from PDBI, dashboard, friction logs.
2. **Evaluate:** Analyse KPI progress against benchmarks.
3. **Reflect:** Host joint review sessions with students and staff.
4. **Revise:** Update policies, training, and ITS parameters.
5. **Report:** Publish progress openly to close the loop.

22. Communication and Dissemination Plan

Target Group	Communication Channel	Frequency	Content Focus
Internal Staff & Students	University Portal, Newsletter	Quarterly	Dashboard updates, ethical alerts, participation opportunities.
External Stakeholders	Website, Annual Report	Yearly	Transparency data, case studies, equity progress.
Academic Community	Conferences, Journals	Ongoing	Research findings from PDBI and Toolkit deployment.



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Public and Media	Press briefings, social media infographics	Annual	Highlights of ethical AI in education impact.
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22. Roadmap for Scaling and Replication

22.1 Cross-Institutional Expansion

- Develop **Regional Hubs** to share validation data and methodological refinements.
- Use **standardized metadata** formats for PDBI to enable meta-analysis.

22.2 Policy Integration

- Engage national education ministries to include BIA principles in accreditation criteria.
- Promote the **Bill of Rights** as a model policy for AI ethics in higher education.

22.3 Sustainability Milestones

Year	Milestone	Indicator of Success
Year 1	Pilot adoption and baseline audit	All core tools active; first transparency report published.

Year 2	Institutionalization	BIA process embedded in QA cycle; first equity scorecard released.
Year 3+	Regional scaling & open-data integration	Toolkit used across 3+ institutions; shared repository online.

Part V Conclusions

Governance and sustainability transform the Behaviour Impact Assessment Toolkit from a project output into an **enduring institutional practice**.

By embedding ethical oversight, transparency, and co-creation into governance structures, universities can ensure that intelligent learning systems evolve responsibly and equitably.

The next section—**Part VI: Annexes**—will provide templates, visual maps, and reference materials that support practical deployment, auditing, and reporting.



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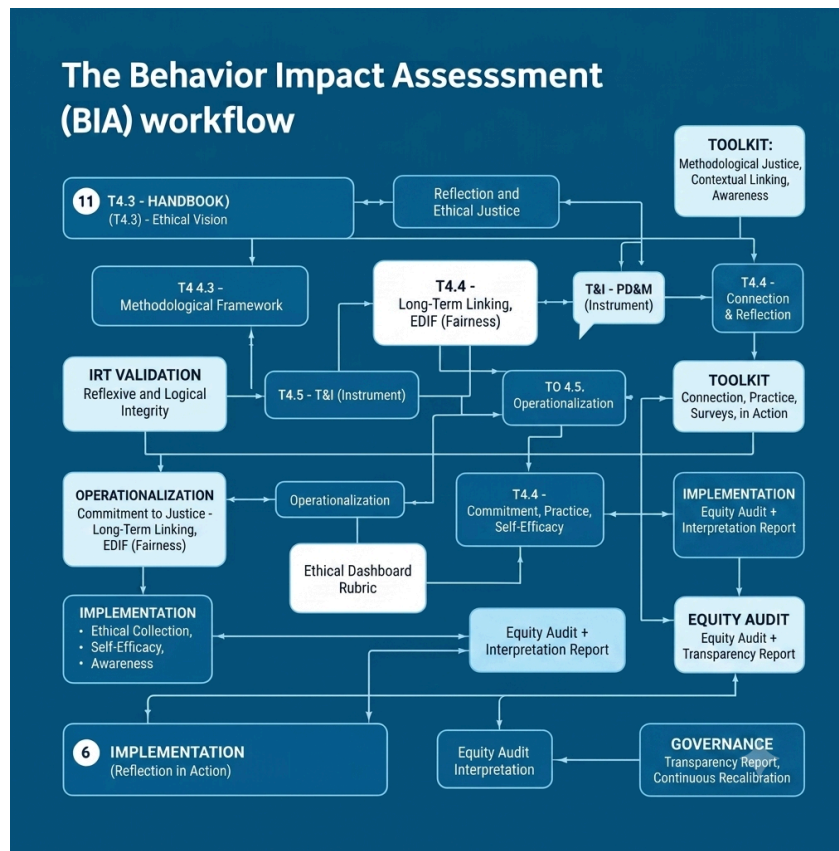
Part VI - Annexes

Annex A - Integrated Workflow Map

A.1 Overview

This map illustrates the complete interaction between the Handbook, T4.3, T4.4, and the Toolkit across the six implementation phases.

It visualizes how ethical principles, psychometric precision, and participatory governance form a continuous, adaptive cycle.



Key Idea:

Each loop completes a “feedback cycle” where data not only measure learning but improve systems, pedagogy, and policy in real time.



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Annex B - Sample Templates

B.1 Tutor Diagnostic Rubric Template

Behaviour Category	Observable Indicators	Context Notes	Tutor Interpretation	Action Taken
Meta-Cognitive Reflexivity	Revises goals after dashboard feedback	_____	Reflective learner; adaptive goal-setting	Encourage journaling
Temporal Orchestration	Works in asynchronous bursts	_____	Effective time management; avoid “disengaged” flag	Note for system recalibration
Ethical Resistance	Challenges or disables repetitive nudges	_____	Displays critical agency	Discuss ethical feedback
Interpretive Responsiveness	Adjusts study strategy after nudges	_____	Demonstrates balanced responsiveness	Reinforce autonomy

Offline Synthesis	Produces strong offline output	_____	Engaged beyond system visibility	Report to dashboard for recognition
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B.2 Friction Log Form (Student Version)

Section	Description / Example	Student Entry
1. System Alert	“You haven’t logged in for 3 days.”	_____
2. Emotional Reaction	Rate: 1 (very negative) → 5 (very positive)	[[]][]][]]
3. Mismatch Explanation	“I was studying offline with peers.”	_____
4. Alternative Suggestion	“Send weekly digest instead of daily alerts.”	_____
5. Context Tags	[] Caregiver [] Part-time [] Limited Wi-Fi [] Other	_____

Purpose: Enable real-time documentation of learner context to humanize algorithmic interpretation.



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B.3 Institutional Equity Audit Checklist

Criterion	Indicator	Data Source	Verified (✓/X)	Notes
Gender Equity in Flagging	≤ 10% variance in alert rates	Dashboard analytics		
DIF Bias Score	$\Delta R^2 < 0.02$ across language groups	PDBI validation report		
Accessibility Compliance	All tools meet WCAG 2.1 standards	IT audit		
Student Participation	≥ 70% completion of PDBI survey	Evaluation summary		
Transparency	Model cards publicly available	Institutional website		
Oversight Activity	Annual Ethics Committee meeting held	Governance minutes		

B.4 Ethical Impact Dashboard — Example View

Dashboard Layer	Description	Key Visuals
Transparency Layer	Displays data sources and feature weights in risk models.	Interactive Sankey diagram linking data streams.
Contestability Portal	Allows student annotations or challenges.	Comment field + “Send to Review” button.
Equity Audit Panel	Shows demographic disparities in alerts and engagement.	Heatmap and percentage differentials.
Review Trigger	Flags patterns exceeding fairness thresholds.	Automated notification to Ethics Committee.



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Annex C - Data Validation and Reporting Templates

C.1 IRT Validation Summary Table

Model	AIC	BIC	Reliability (α)	Fit (CFI)	RMS EA	Decision
Rasch (1PL)						
2PL						
GRM						Selected Model

Reminder: Select model with lowest AIC/BIC and acceptable fit indices.

C.2 Longitudinal Growth Analysis Snapshot

Construct	Time Point	Mean (θ)	Slope	Trend	Interpretation
Academic Commitment	T0 → T2	+0.45	Positive	↑	Increasing motivation

Self-Efficacy	T0 → T2	+0.28	Stable	→	Maintained confidence
Digital Awareness	T0 → T2	+0.65	Strong Positive	↑↑	Growth in ethical literacy

C.3 Annual Transparency Report Template

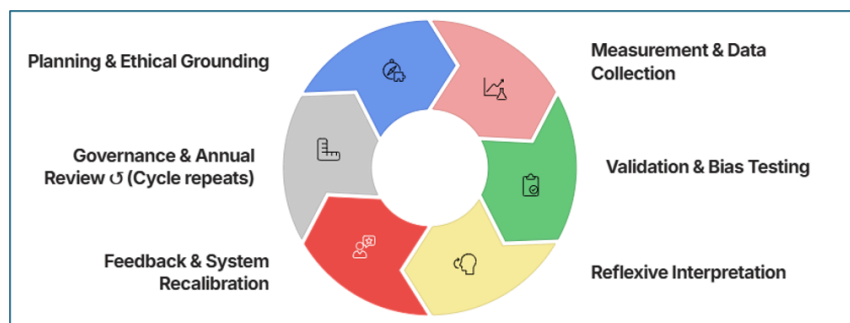
Section	Content Summary	Responsible Unit	Status
Algorithmic Overview	Models, features, and weight updates	Data Science Team	
Equity Metrics	Gender, discipline, accessibility variance	Equity Panel	
Participatory Feedback	Number of Friction Logs, contestations	Student Oversight Board	
Policy Changes	Updates to Bill of Rights and governance	Council / IEC	
Public Disclosure	URL of model cards, audit reports	Communication Office	



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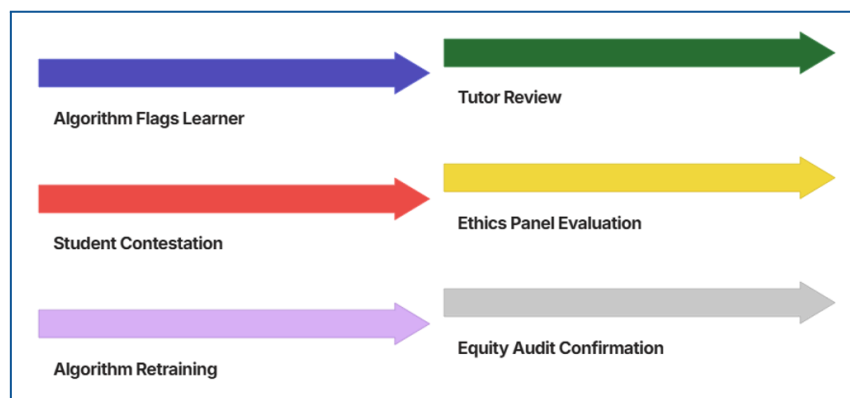
Annex D - Visual Reference Models

D.1 Behaviour Impact Assessment Cycle



Goal: Maintain a self-learning institutional ecosystem.

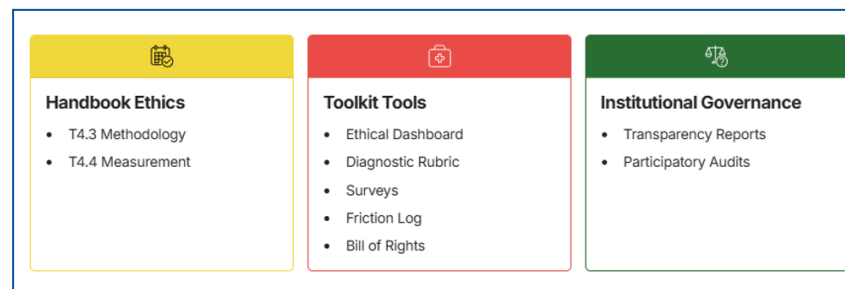
D.2 Behaviour Impact Assessment Cycle



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This model ensures human oversight, contestability, and traceable accountability.

D.3 Ethical Ecosystem Overview



Annex E - Glossary of core concepts

Term	Definition
Adaptive Fidelity	The ability of an assessment tool to retain conceptual consistency while allowing local contextual adaptation.
Contextual Integrity	Ensuring that data interpretation respects learners' personal, cultural, and situational realities.
Reflexive Analytics	Analytical systems designed to invite reflection and contestation rather than passive acceptance of results.
Differential Item Functioning (DIF)	Statistical method to detect whether test items function differently across subgroups, ensuring fairness.
Epistemic Freezing	The risk of early data or labels permanently defining a learner's profile without accounting for change.
Human-in-the-Loop (HITL)	Governance model in which humans maintain interpretive authority over automated analytics.
Friction Log	A student-centered tool for recording emotional or contextual misalignments with system prompts.

Digital Self-Efficacy	Learner's confidence in managing and customizing digital learning tools.
Equity Audit	Systematic examination of data to identify and address inequities in algorithmic or institutional outcomes.
Model Card	Public document describing how an algorithm or ITS model operates, including data sources, assumptions, and limitations.

Annex F - References and Acknowledgments

F.1 Core References

- Floridi, L. (2013). *The Ethics of Information*. Oxford University Press.
- Selwyn, N. (2022). *Education and Technology: Key Issues and Debates (4th ed.)*. Bloomsbury Academic.
- Prinsloo, P. & Slade, S. (2017). *Ethics and Learning Analytics: Charting the (Un)charted*.
- Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial Intelligence in Education: Promises and Implications for Teaching and Learning*.
- Broughan, C. & Prinsloo, P. (2022). *Re-imagining Learning Analytics through the Lens of Social Justice*.



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F.2 Toolkit and Deliverables Referenced

- *Handbook: Mapping and Evaluating Existing Impact Assessment Methodologies and Tools.*
- *T4.3: Methodology and Content Framework for the Psychometric Tool Evaluating Pro-Digital Behaviour Factors.*
- *T4.4: Full Psychometric Questionnaire – Pro-Digital Behaviour Inventory (PDBI).*
- Toolkit Components (Ethical Impact Dashboard, Diagnostic Rubric, Surveys, Friction Log, Digital Learning Bill of Rights).
-

F.3 Acknowledgments

Developed collaboratively under the HITS project consortium, integrating contributions from:

- **Centro Studi Pluriversum (CSP)** – Lead partner for methodological design.
- **UNIVA, UV, UNICAM** – Psychometric validation and academic oversight.
- **Participating Higher Education Institutions** – Pilot implementation and contextual testing.
- **Student and Tutor Advisory Panels** – Co-design and reflexive feedback.

Conclusion of the Guideline and Toolkit

The *Behaviour Impact Assessment Guideline and Toolkit* consolidates three dimensions of innovation:

1. **Scientific Integrity:** rigorous psychometric modeling ensures reliability and fairness.
2. **Ethical Accountability:** embedded rights, transparency, and contestability redefine digital governance.
3. **Participatory Culture:** learners, educators, and institutions co-create knowledge, ensuring lasting relevance and justice.

By following this framework, institutions transform Intelligent Tutoring Systems into **ecosystems of ethical intelligence**—where data empower, reflection guides, and learning remains profoundly human.



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