

Supplementary Materials S1 of “Development and Empirical Validation of an AI-enhanced Cultural Learning Dashboard for Measuring Samskara, Cesta, and Krtya in Balinese Vocational Students”

A. Figure

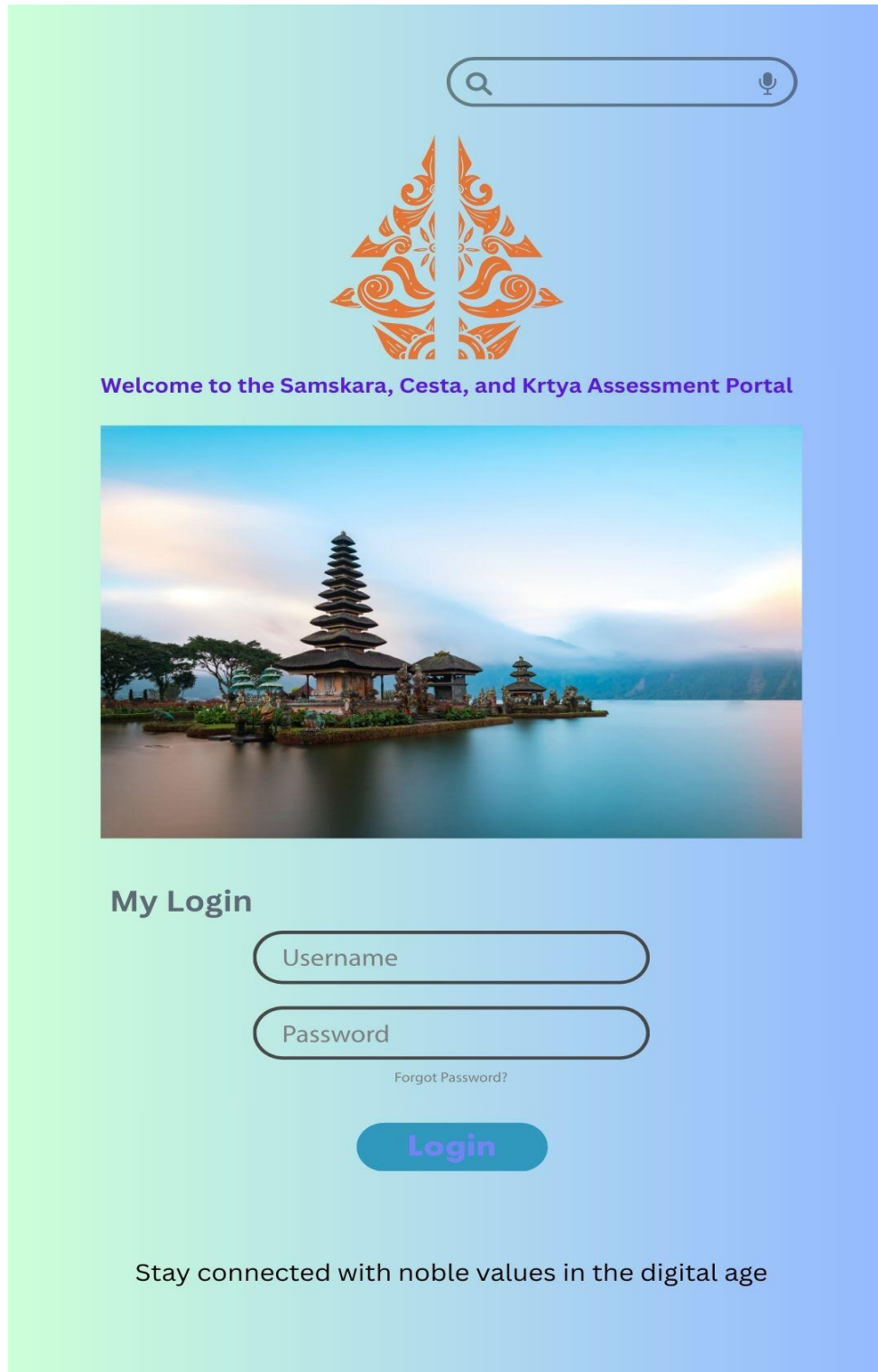


Fig. S1. Login page interface demonstrating minimalist design with Balinese cultural motifs. The interface emphasizes recognition over recall to accommodate varying digital literacy levels among vocational students.

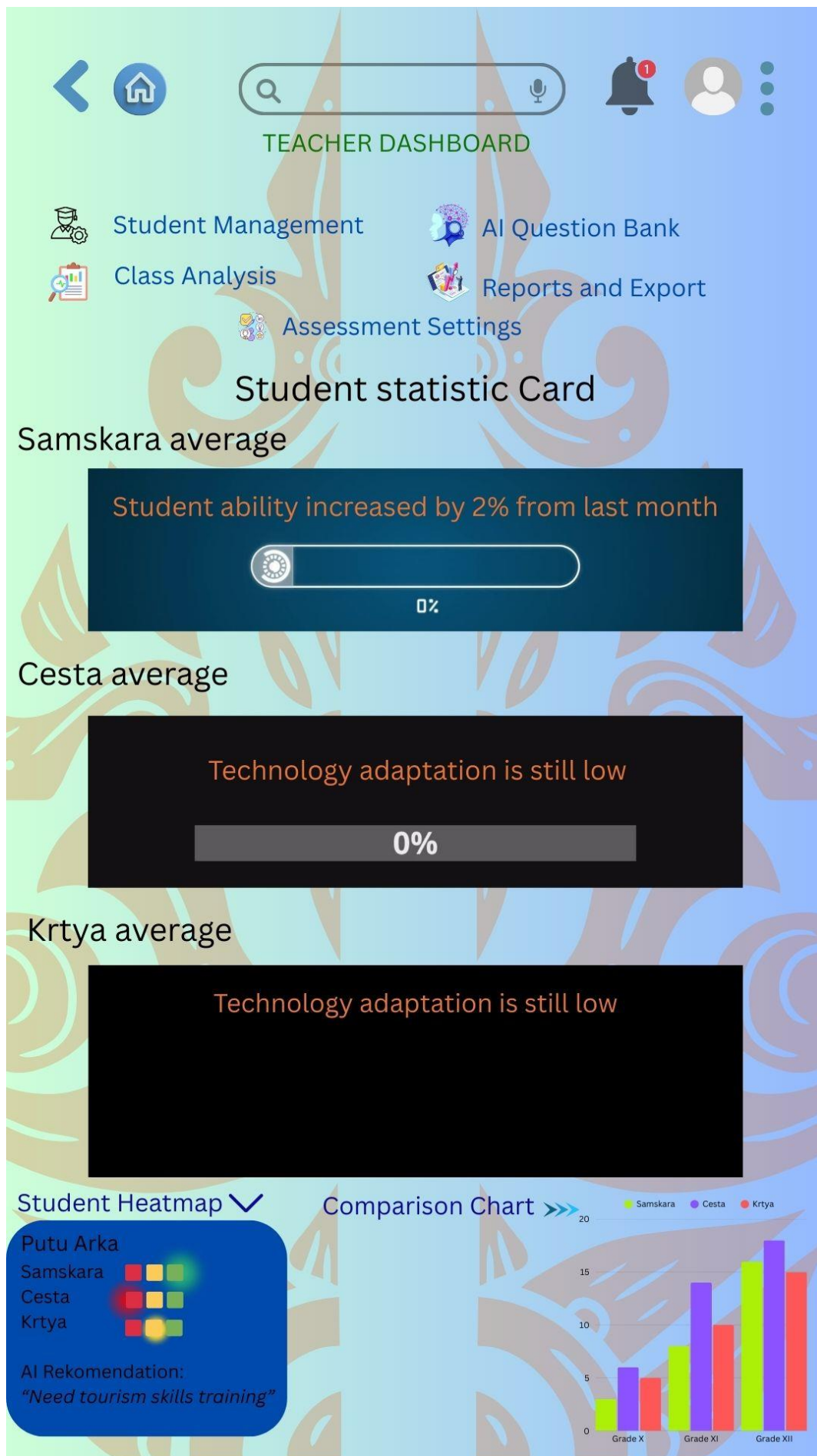


Fig. S2. Teacher dashboard overview showing holistic progress tracking across Samskara, Cesta, and Krtya dimensions. The design integrates cultural elements with data visualization for pedagogical decision-making.

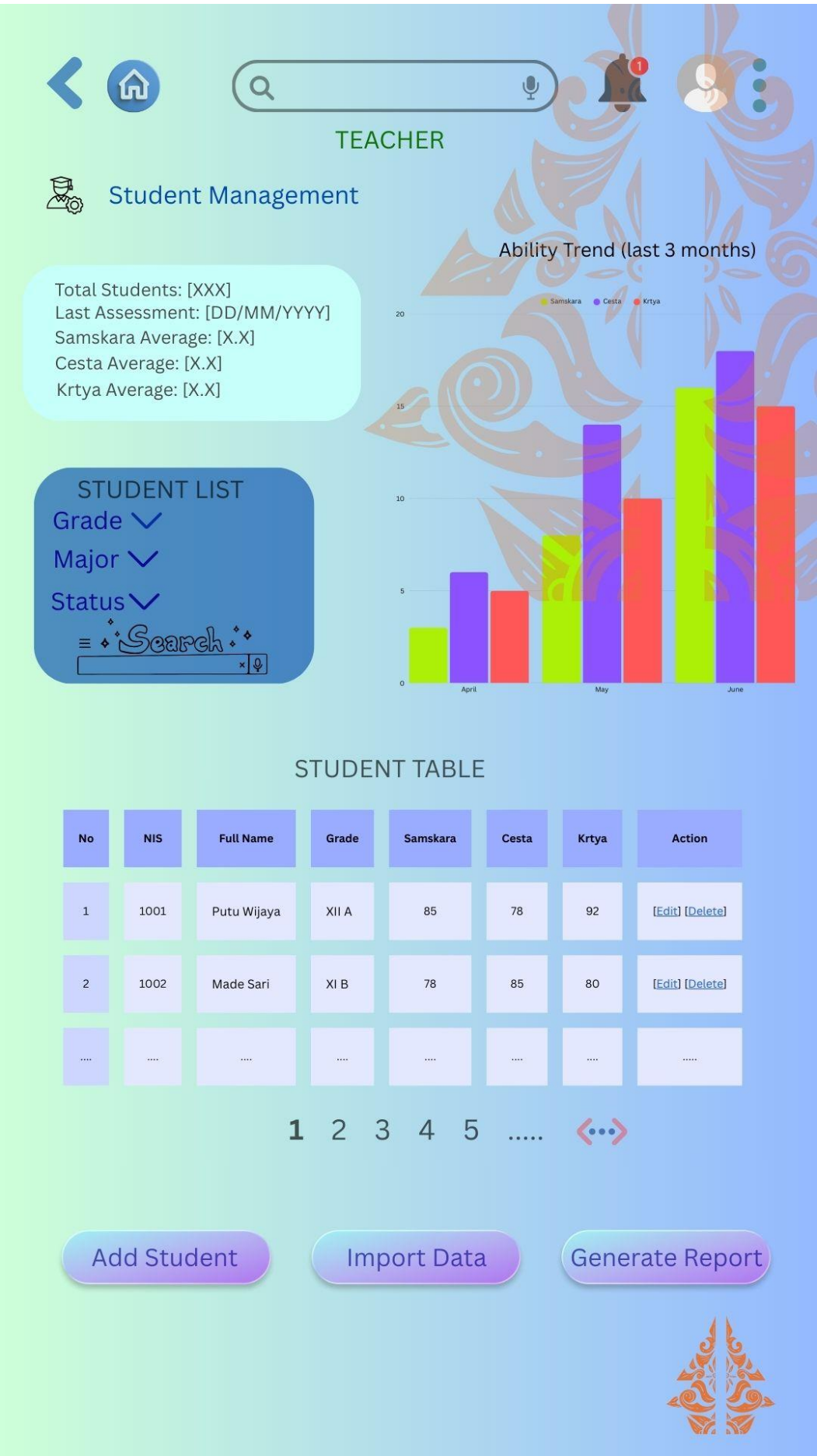
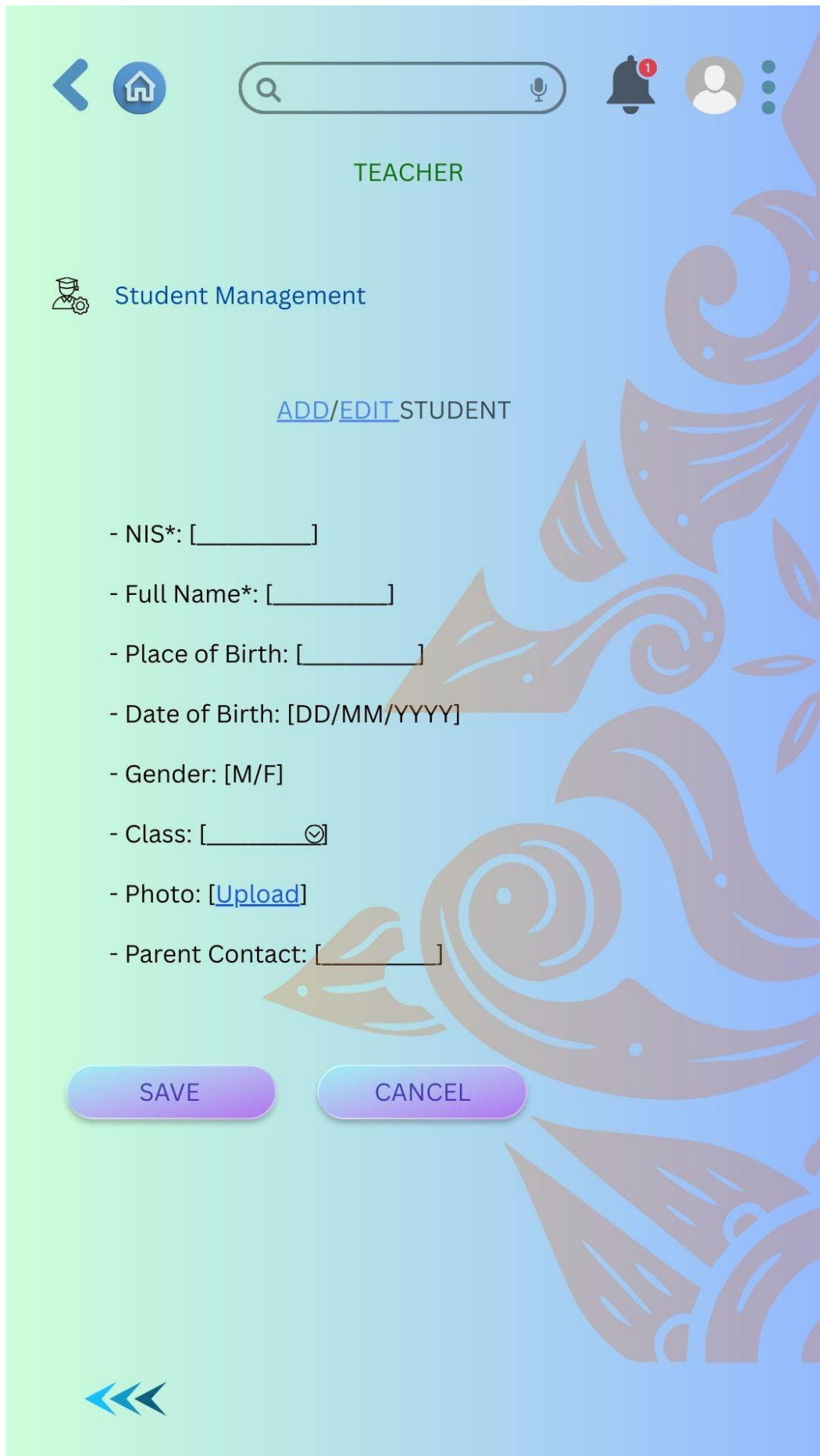


Fig. S3. Student management interface displaying class roster with competency progress indicators. Color coding visualizes performance levels for quick teacher reference.



The image shows a mobile application interface for a 'TEACHER' user. At the top, there is a navigation bar with a back arrow, a home icon, a search bar with a microphone icon, a notification bell with a red '1', a user profile icon, and a menu icon. Below the navigation bar, the word 'TEACHER' is displayed in green. The main content area is titled 'Student Management' with a graduation cap icon. Below this, there is a link 'ADD/EDIT STUDENT' in blue. The form contains several input fields: 'NIS*: []', 'Full Name*: []', 'Place of Birth: []', 'Date of Birth: [DD/MM/YYYY]', 'Gender: [M/F]', 'Class: []' with a dropdown arrow, 'Photo: [Upload]', and 'Parent Contact: []'. At the bottom of the form are two buttons: 'SAVE' and 'CANCEL'. The background of the form has a decorative pattern of stylized leaves and a graduation cap. At the bottom left of the screen, there are three blue arrows pointing left.

TEACHER

Student Management

[ADD/EDIT STUDENT](#)

- NIS*: []

- Full Name*: []

- Place of Birth: []

- Date of Birth: [DD/MM/YYYY]

- Gender: [M/F]

- Class: []

- Photo: [Upload](#)

- Parent Contact: []

SAVE CANCEL

Fig. S4. Student profile editor illustrating data input fields aligned with cultural competency frameworks. The form captures both demographic and competency baseline data.

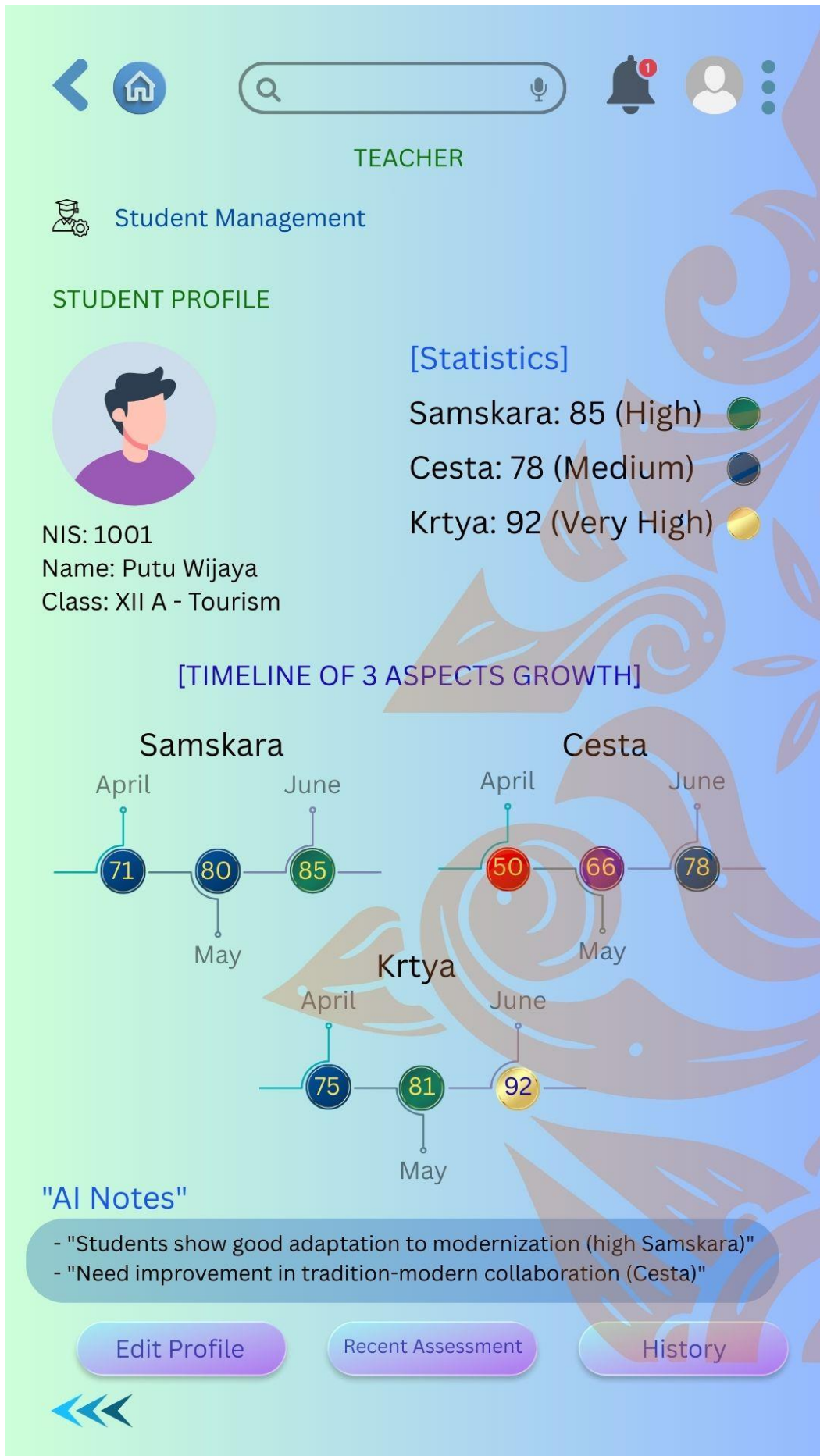


Fig. S5. Individual student profile presenting comprehensive competency analytics. The radar chart visualizes relative strengths across Samskara, Cesta, and Krtya dimensions.

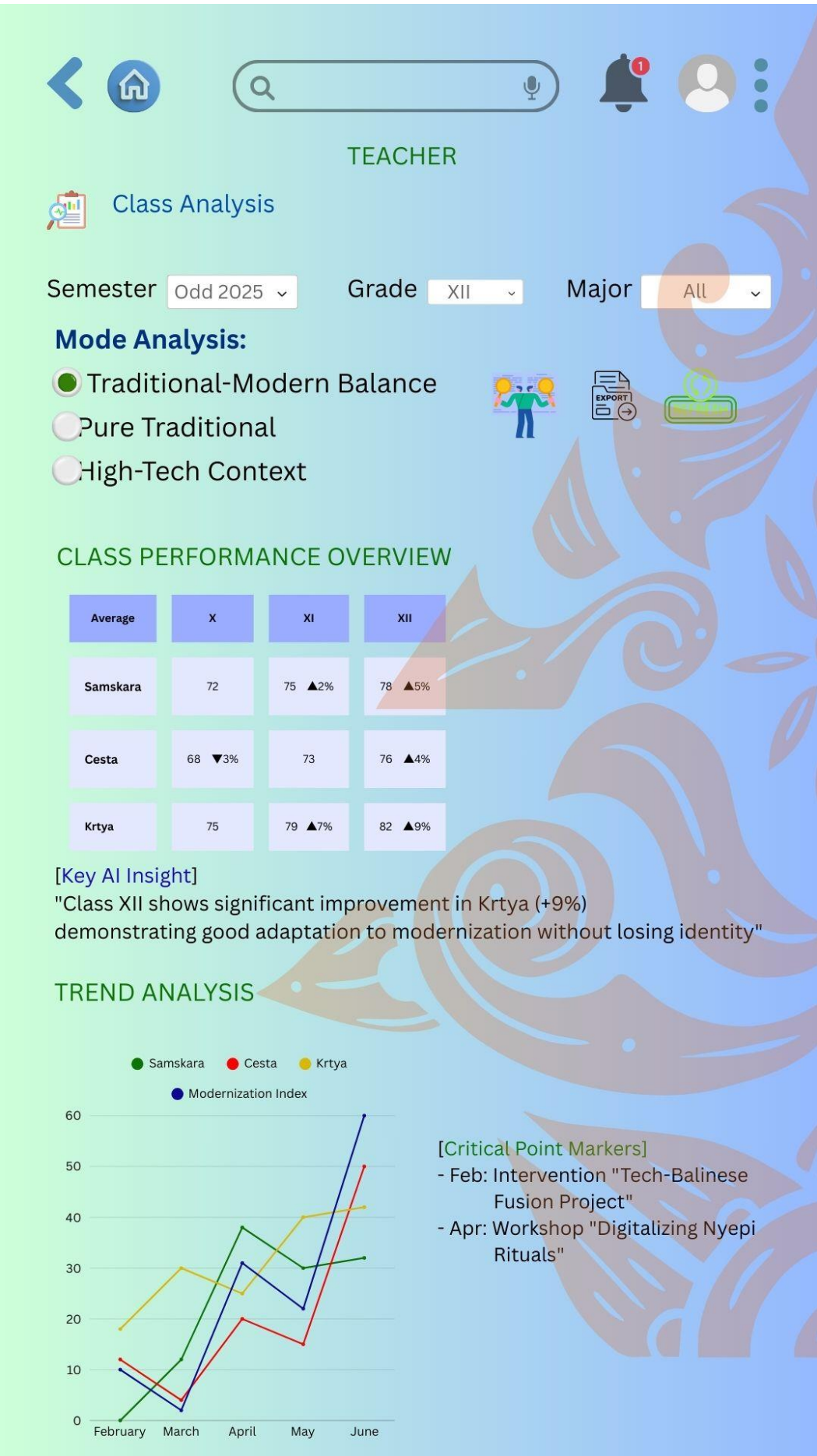


Fig. S7. Class-level analytics dashboard aggregating performance data across competency dimensions. Comparative visualizations identify group-level patterns and outliers.



Fig. S8. Competency distribution analysis visualizing class performance across Samskara, Cesta, and Krtya. Heat maps indicate areas requiring instructional attention.

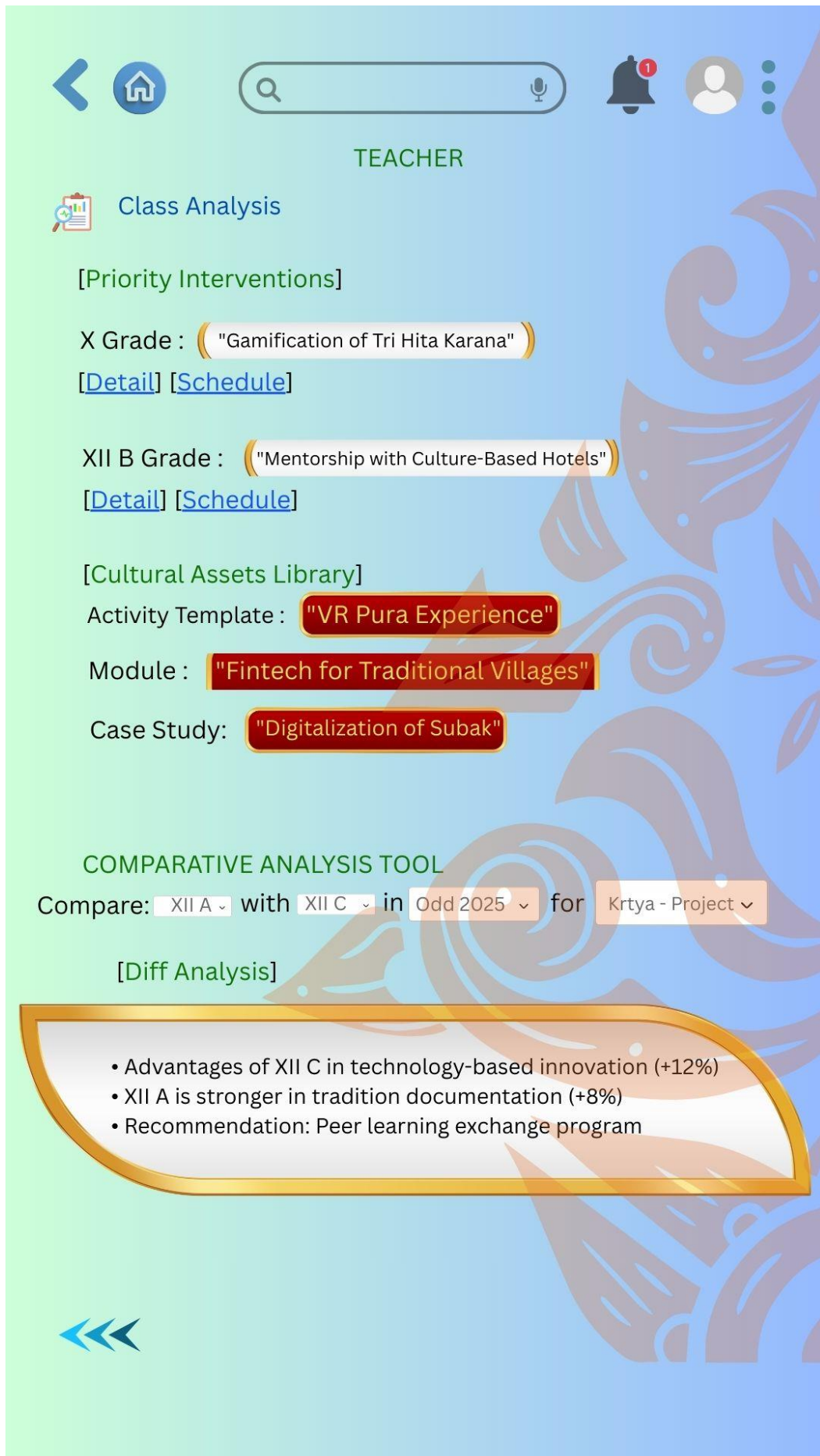


Fig. S9. Intervention priority matrix identifying students requiring targeted support. The algorithm prioritizes based on competency gaps and growth potential.

TEACHER

AI Question Bank

Active Class: XII

[Question Bank](#) |
 [Template](#) |
 [Cultural Collection](#) |
 [AI Generator](#) |
 [Trial](#)

☐ Samskara
 ☐ Cesta
 ☐ Krtiya
 ☒ Traditional Village

☒ Easy
 ☒ Intermediate
 ☒ Hard
 ☒ Modern Hotel

☐ Text
 ☐ Image
 ☐ Video
 ☐ AR
 ☒ Ritual Digitalization
 ☒ Sustainable Tourism

[\[Search for questions...\]](#)

DYNAMIC QUESTION LIST

[Question #T-228]

Type: Samskara - Adaptation of Traditional Values

Difficulty: Intermediet

"When guiding tourists in a temple, you see them using tablets to take notes. How do you respond professionally while respecting the customs?"

Options:

[A\) Prohibit the use of devices](#)
[B\) Suggest photos without flash](#)
[C\) Invite discussion of the sacred meaning of the place](#)
[D\) Give special time for documentation](#)

AI Tags: #technology_in_temples #guide_ethics #cultural_adaptation

Used: 12x | Success Rate: 78%

[\[Actions\]](#)
[\[Edit\]](#)
[\[Preview\]](#)
[\[Duplicate\]](#)
[\[Delete\]](#)

Fig. S10. AI-generated question bank showing adaptive assessment items. Questions are tagged by competency dimension and difficulty level for personalized testing.

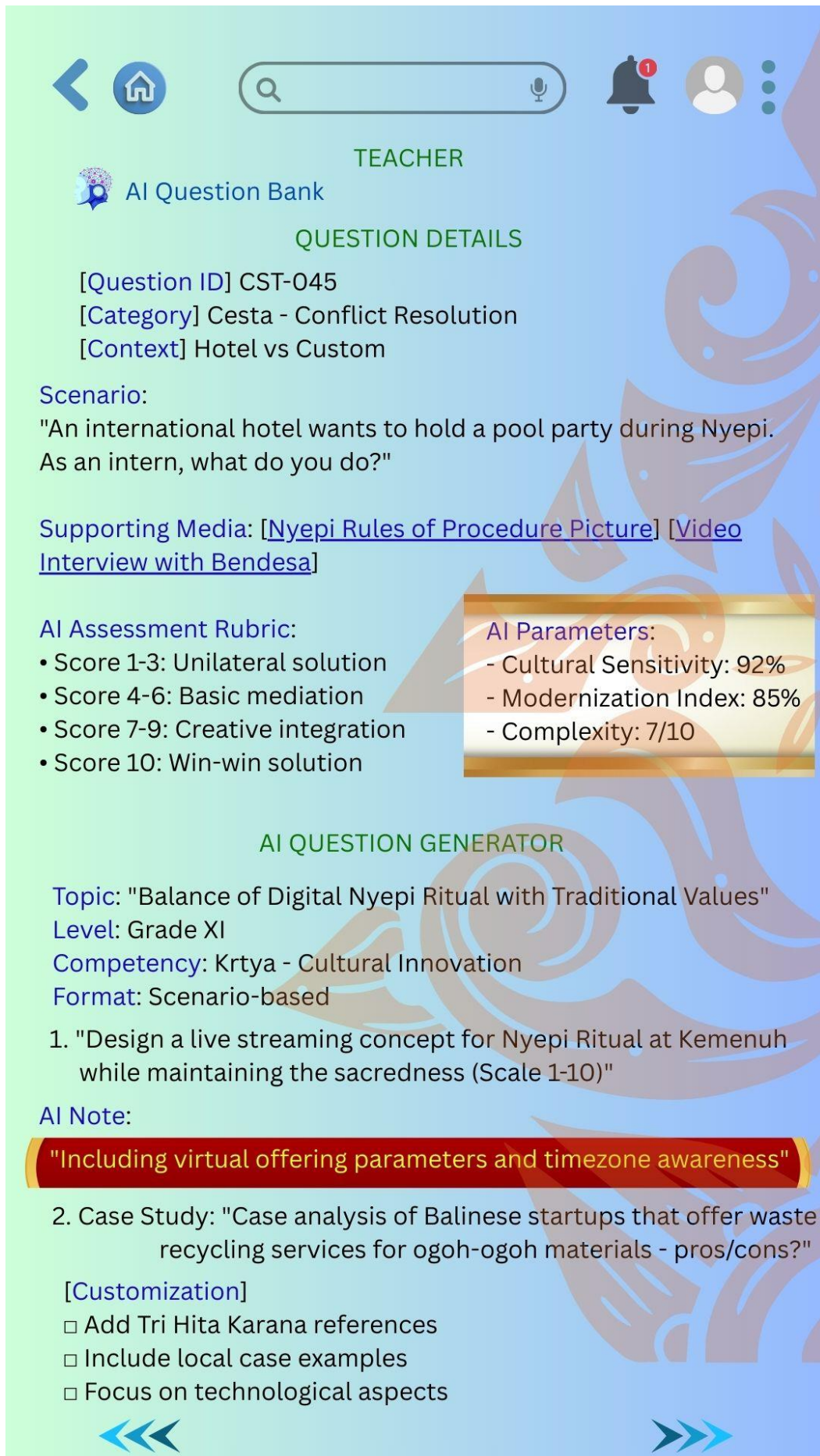


Fig. S11. Question analytics interface displaying metadata and performance statistics. AI-generated difficulty indices and discrimination values guide question selection.

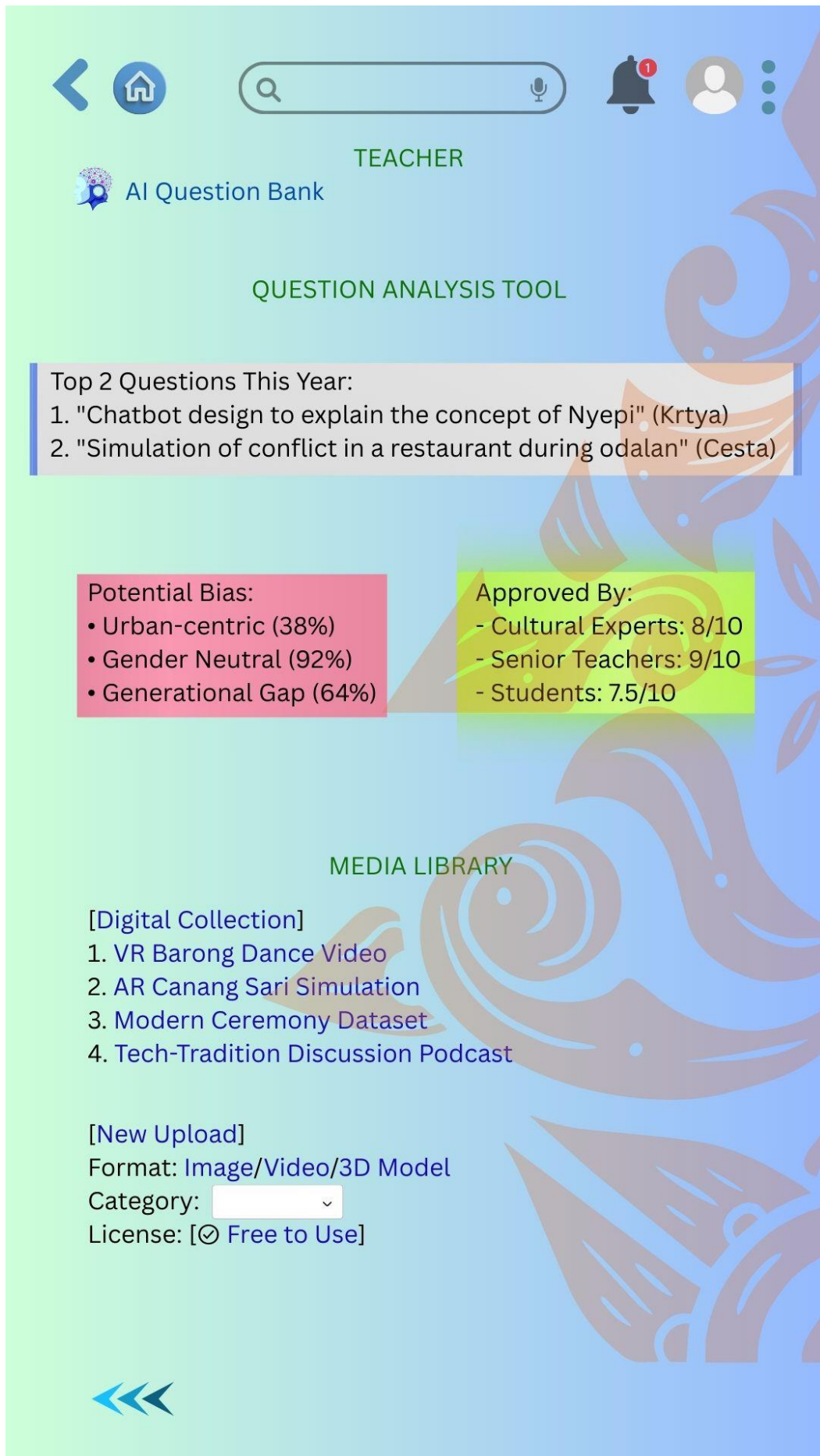


Fig. S12. Question quality analyzer using AI to evaluate assessment item effectiveness. The tool identifies biased or poorly performing questions.

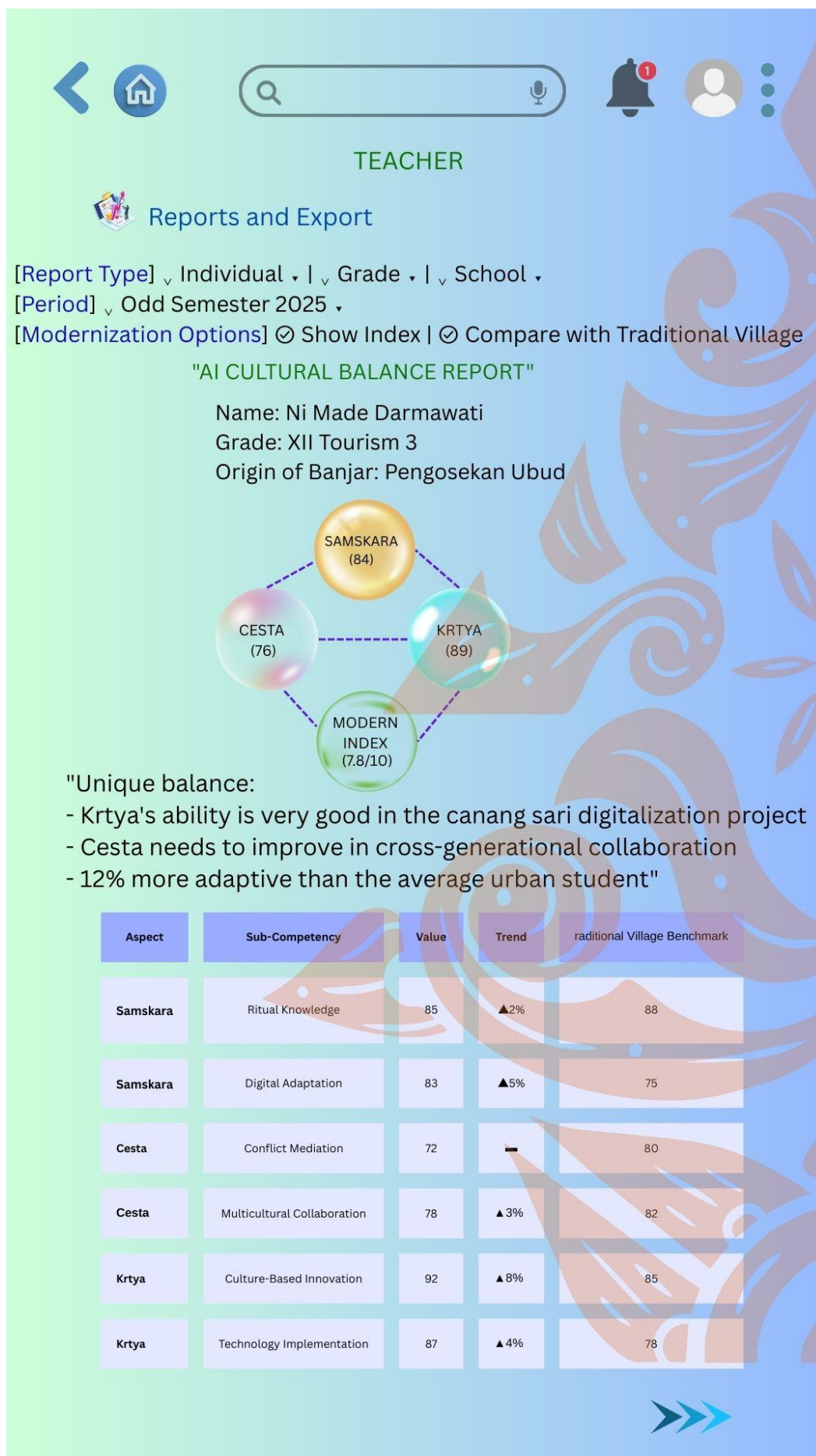


Fig. S13. Reporting and export interface enabling customizable report generation. Teachers can select competency dimensions and time periods for analysis.



Fig. S14. Cultural competency growth visualization mapping development trajectories. The interface shows progression in Balinese value internalization over time.

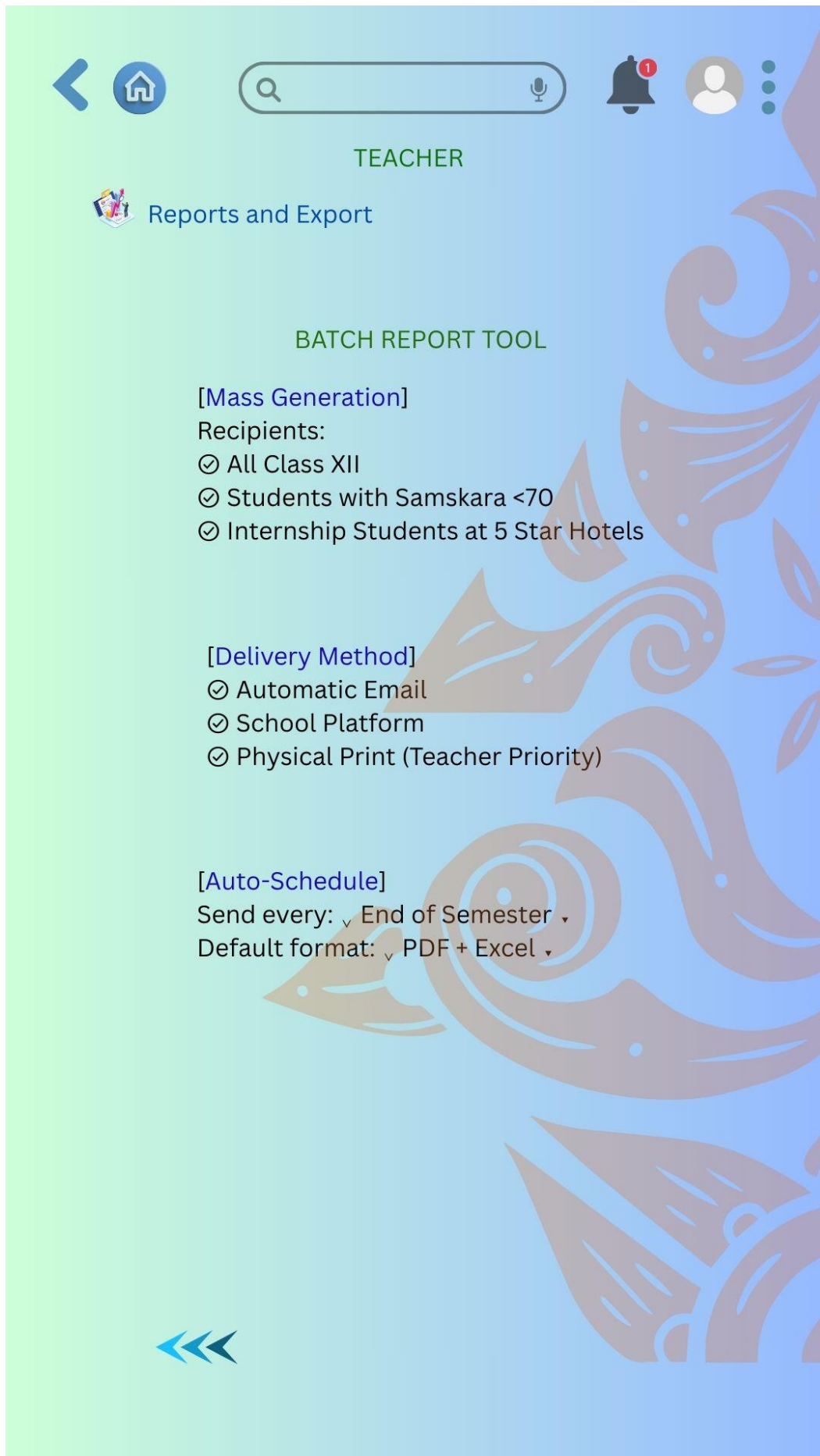


Fig. S15. Batch reporting tool for efficient generation of multiple student reports. Automated templates ensure consistency in assessment documentation.

TEACHER

Assessment Settings

[Active Assessment](#) | [Template](#) | [Schedule](#) | [Cultural Integration](#) | [AI Settings](#) | [Audit](#)

[Assessment Card]

"Mid Semester Score - Digital Culture Adaptation"

— Status: Active (25/30 students completed)

— Period: June 10-25, 2025

— Components:

- Samskara (40%)
- Cesta (30%)
- Krtya (30%)

— Special Features: Auto-adjustment based on village origin

[\[Quick Actions\]](#) [\[Duplicate\]](#) [\[Pause\]](#) [\[Real-time Analysis\]](#)

NEW ASSESSMENT

[Assessment Name]
"Digital Nyepi Competency Test 2024"

[Basic Configuration]

☒ Combine Tradition-Modern Values

☐ Strict Customary Mode (tradition only)

☐ Full Technology Mode

[Score Weight]

Samskara: ☐ 40% (Default: Ritual Knowledge 60%, Digital Adaptation 40%)
Cesta: ☐ 30% (Collaboration 50%, Mediation 50%)
Krtya: ☐ 30% (Real Project 70%, Innovation 30%)

[Bali Specific Settings]

- Balinese Calendar: ☒ Adjust to holidays

- Languages: ☒ Balinese ☒ Indonesian ☒ English

- Cultural Validator: [Select from a list of traditional elders...]

Fig. S16. Assessment configuration panel allowing customization of evaluation parameters. Settings include weighting of competency dimensions and assessment modalities.

TEACHER

Assessment Settings

ADVANCED AI SETTINGS

[Adaptive Engine]

☒

 Adjust difficulty based on village of origin

☒

 Enable cultural bias detection

☒

 Use local language model (Bali AI)

[Cultural Parameters]

Class Modernization Level: TraditionalModern

Customary Sensitivity: Low

Euphoria Index: Auto

[Custom Threshold]

Aspect	Minimum Pass	Ideal Target
Samskara	65	85
Cesta	60	80
Krtya	70	90

SCHEDULE & TRIGGER

[Digital Bali Calendar]

Select important days: Nyepi

Avoid periods: Certain Monts

[Automatic Trigger]

☒

 Start assessment when students log in from tourist locations

☒

 Reminder via WhatsApp based on mother tongue

☒

 Auto-pause when detecting school rituals

Fig. S17. Advanced AI configuration interface for adjusting algorithm parameters. Settings control sensitivity, bias mitigation, and explainability features.

[←](#) [🏠](#) [🔔](#) [👤](#) [⋮](#)

TEACHER

[🎨](#) Assessment Settings

CULTURAL INTEGRATION

[\[Cultural Reference\]](#)

Digital Library: ▾

Resource Person: ▾

[\[Supporting Media\]](#)

- ☑ Use AR Puri as a background
- ☑ Include traditional gamification (Mecatu)
- ☑ Question templates based on folklore

PREVIEW & PUBLISH

[\[Student Display Simulation\]](#)

"Sample Question for Students from Ubud Village:
'Design a chatbot that explains the concept of Tri Hita Karana for foreign tourists with...'"

[\[AI Validation\]](#)

Check: ☑ Does not conflict with customary law

Cultural Suitability Score: 92/100

Warning: "Question #12 requires consultation with the village head"

[\[Save Draft\]](#) [\[Preview\]](#) [\[Publish\]](#) [\[Submit Validation\]](#)

[←←←](#)

Fig. S18. Cultural integration settings enabling localization of assessment criteria. The interface allows adaptation to specific Balinese cultural contexts.

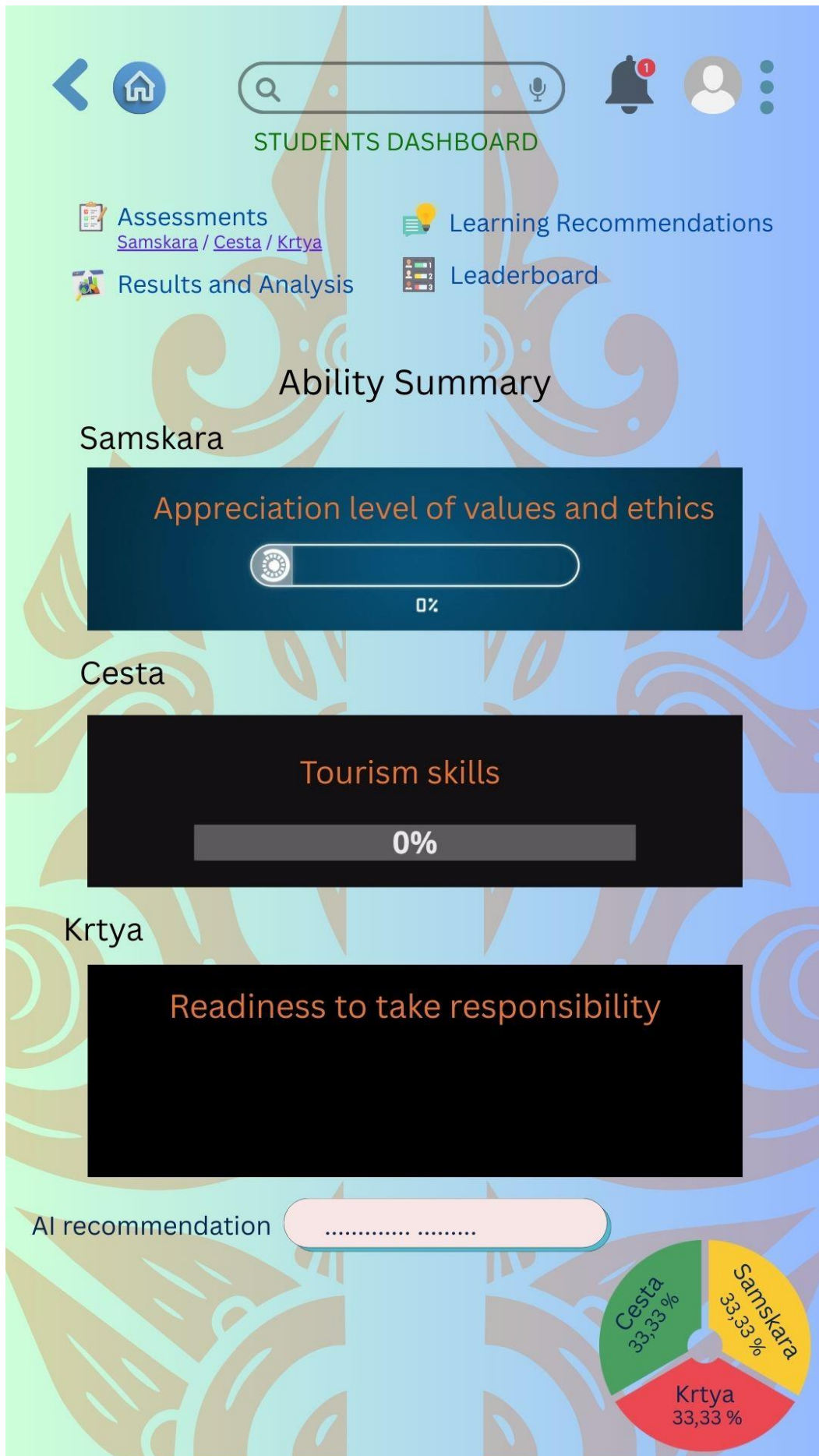


Fig. S19. Student dashboard interface providing personalized competency overview. Visual progress indicators and AI feedback support self-regulated learning.

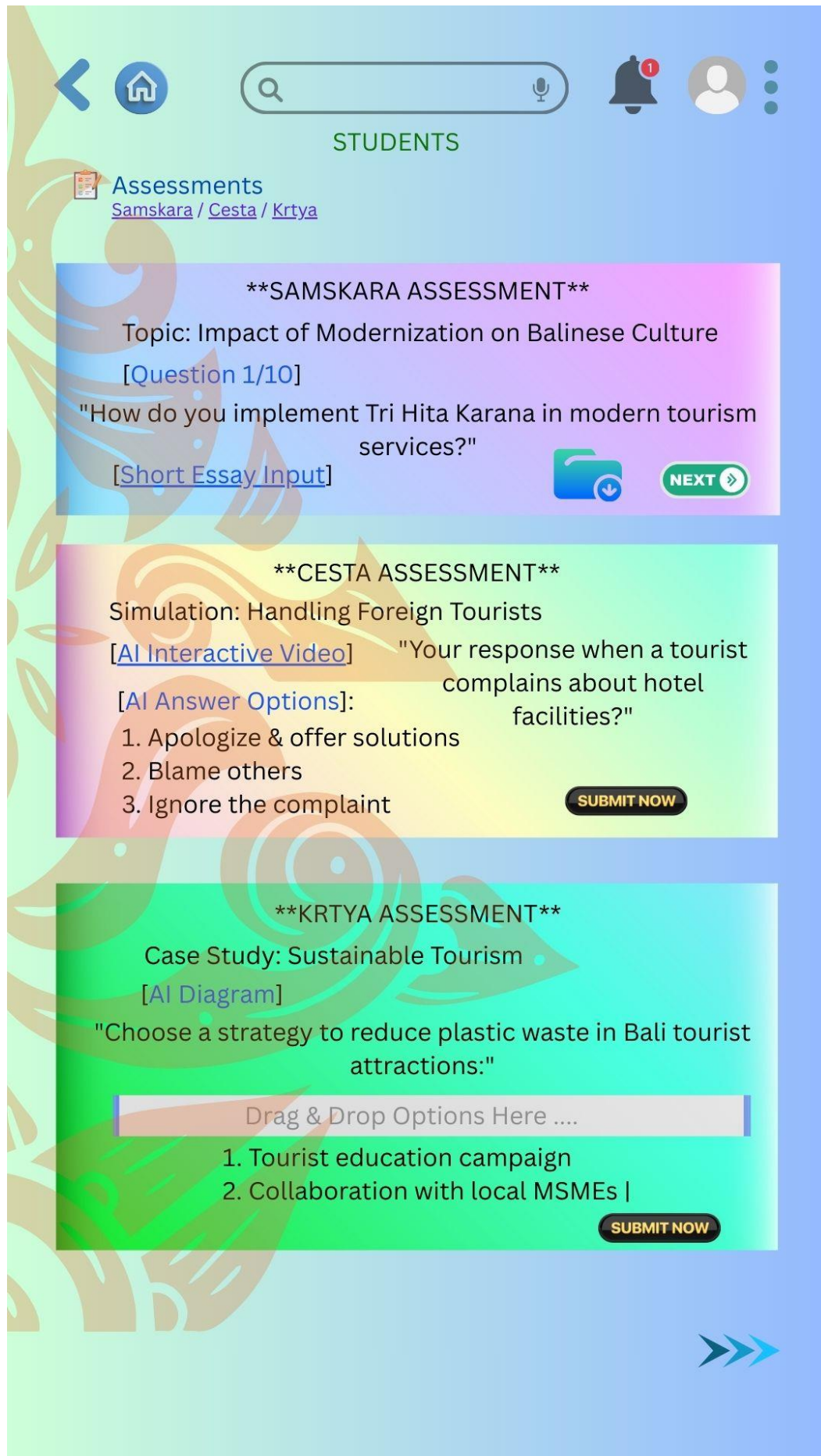


Fig. S20. Student assessment portal showing available and completed evaluations. The interface guides students through competency measurement activities.

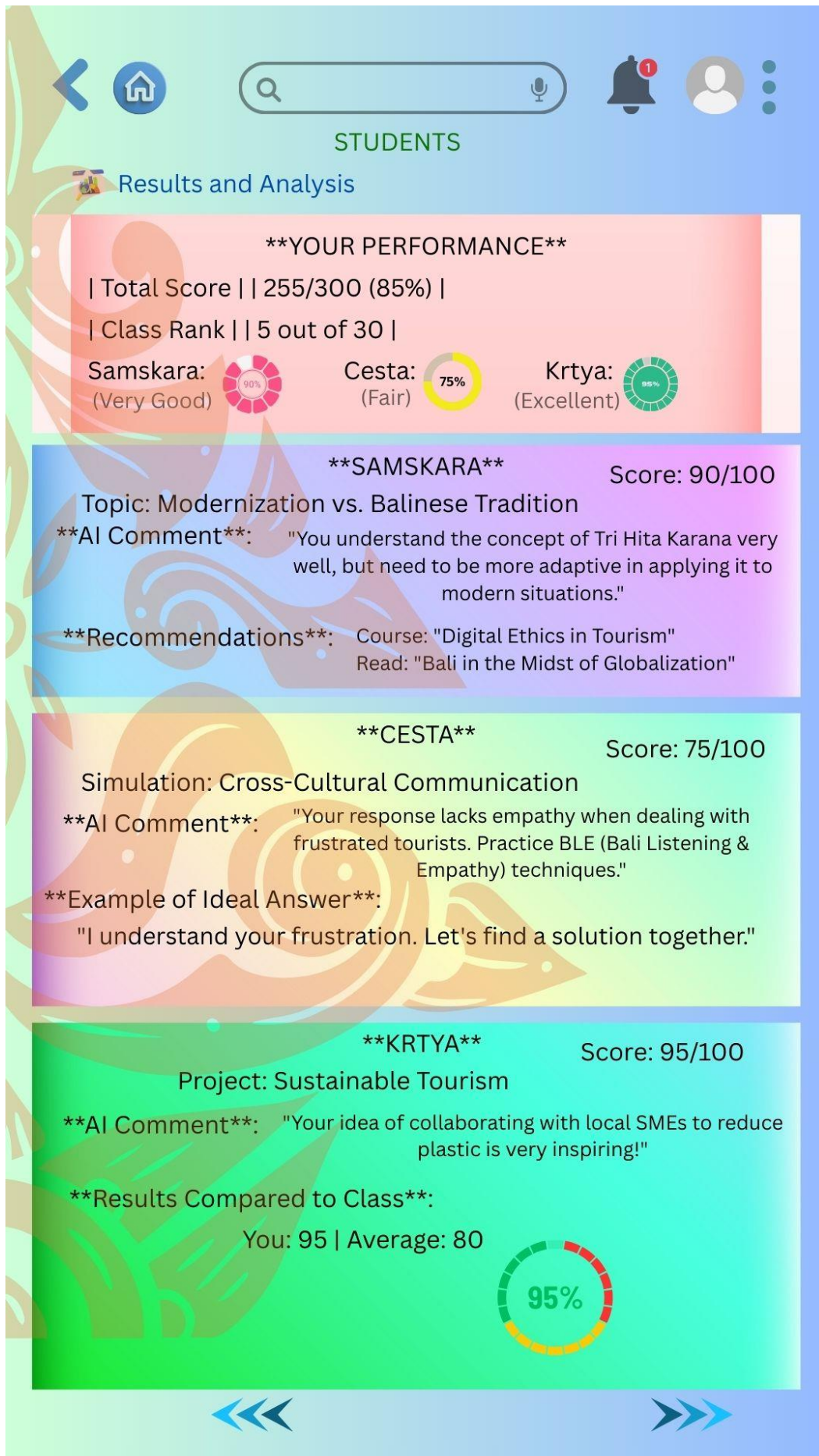


Fig. S21. Assessment results visualization presenting performance analytics with comparative benchmarks. Students can view their standing relative to class averages.



Fig. S22. Detailed competency breakdown showing performance across sub-dimensions. Actionable insights guide targeted skill development



Fig. S23. AI-generated learning recommendations based on competency gaps. Personalized resources address specific areas for improvement.

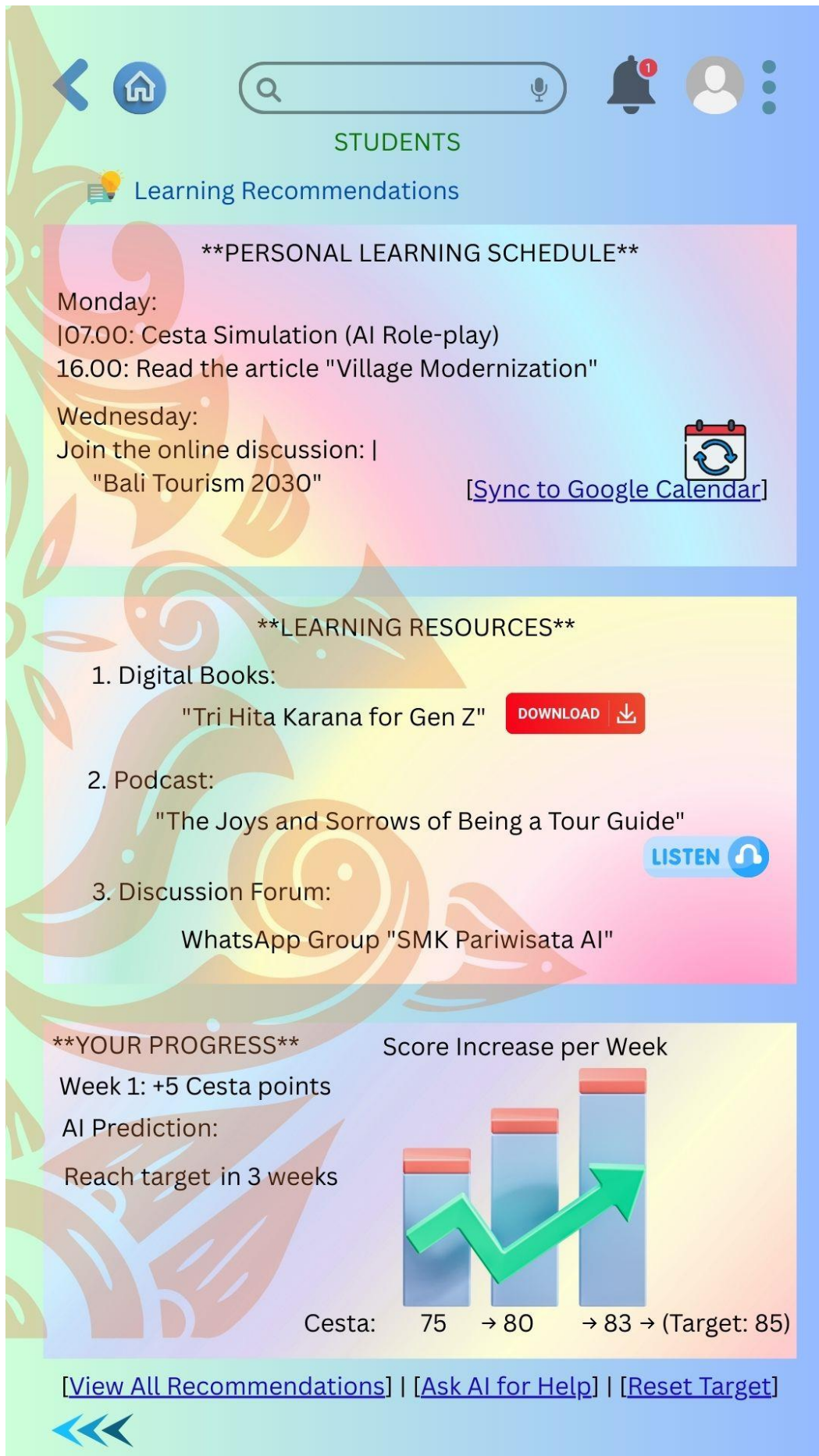


Fig. S24. Extended learning pathway suggestions showing sequential skill development activities. Recommendations are prioritized by impact potential.

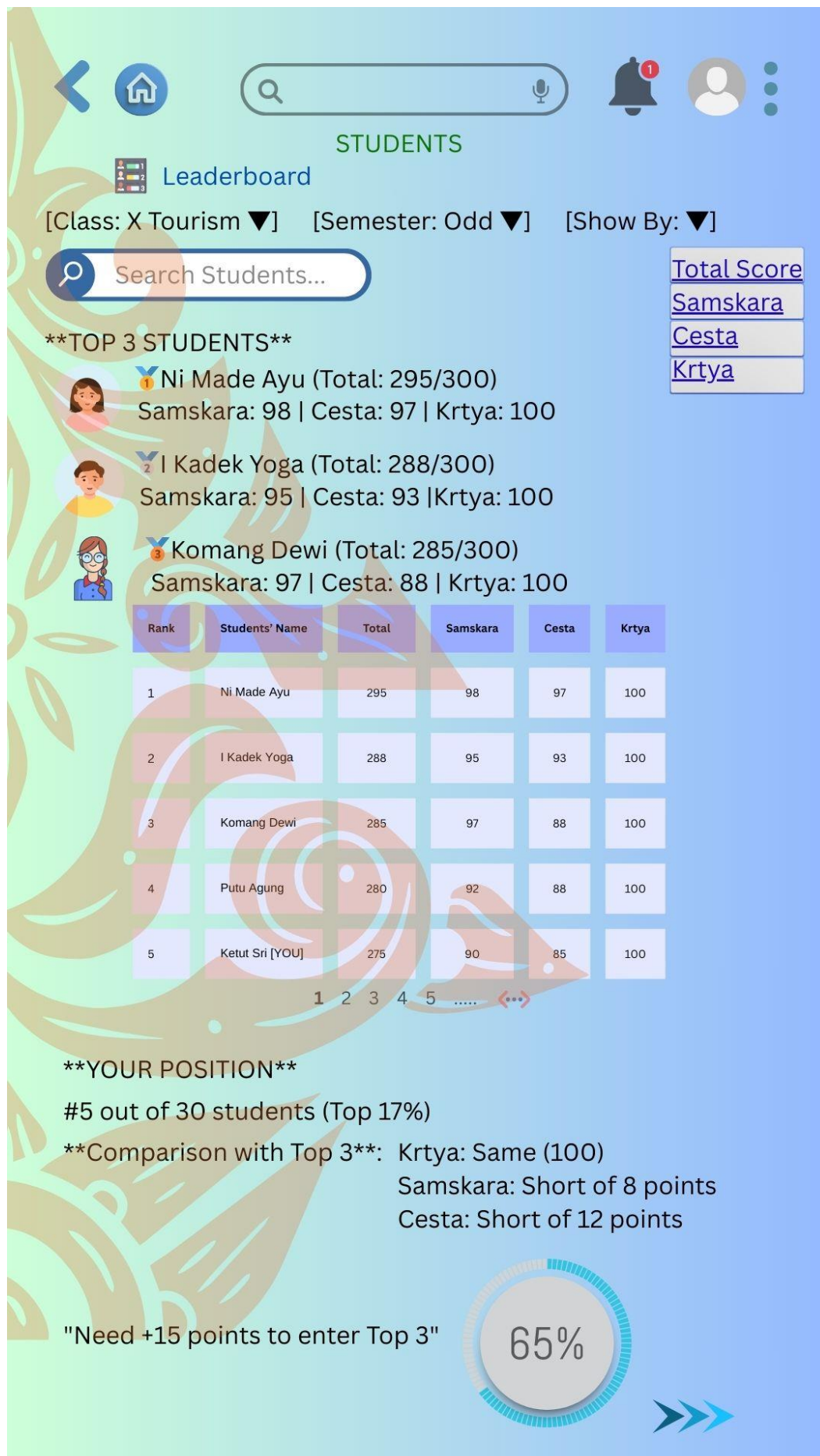


Fig. S25. Gamified leaderboard interface fostering healthy competition. The display anonymizes identities while recognizing achievement across competency dimensions.



Fig. S26. Detailed leaderboard analytics showing progression trends and achievement milestones. The interface balances motivation with collaborative learning values.

B. Tabel S1: Comprehensive Validation Results

Table S1.1: Participant demographics and baseline characteristics

Characteristic	Students (n = 45)	Teachers (n = 12)	Total (N = 57)
Gender	Female	27 (60.0%)	8 (66.7%)
	Male	18 (40.0%)	4 (33.3%)
Age (Years)	Mean ± SD	17.4 ± 0.9	38.2 ± 6.7
	Range	16-19	28-52
Digital Literacy Level	Basic	12 (26.7%)	1 (8.3%)
	Intermediate	25 (55.6%)	4 (33.3%)
	Advanced	8 (17.8%)	7 (58.3%)
Teaching Experience (Years)	<5	-	2 (16.7%)
	5-15	-	6 (50.0%)
	>15	-	4 (33.3%)
School Location	Denpasar (Urban)	18 (40.0%)	4 (33.3%)
	Gianyar (Semi-urban)	15 (33.3%)	4 (33.3%)
	Badung (Mixed)	12 (26.7%)	4 (33.3%)

Table S1.2: Detailed System Usability Scale (SUS) results

SUS Item	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	Mean Score	SD
1. I think that I would like to use this system frequently	0 (0%)	2 (3.5%)	5 (8.8%)	35 (61.4%)	15 (26.3%)	4.10	0.78
2. I found the system unnecessarily complex	20 (35.1%)	25 (43.9%)	8 (14.0%)	3 (5.3%)	1 (1.8%)	1.94	0.92
3. I thought the system was easy to use	0 (0%)	3 (5.3%)	7 (12.3%)	32 (56.1%)	15 (26.3%)	4.04	0.81
4. I think that I would need assistance to be able to use this system	18 (31.6%)	22 (38.6%)	10 (17.5%)	5 (8.8%)	2 (3.5%)	2.14	1.05
5. I found the various functions in this system were well integrated	1 (1.8%)	4 (7.0%)	9 (15.8%)	30 (52.6%)	13 (22.8%)	3.88	0.91
6. I thought there was too much inconsistency in this system	25 (43.9%)	20 (35.1%)	8 (14.0%)	3 (5.3%)	1 (1.8%)	1.84	0.89
7. I would imagine that most people would learn to use this system very quickly	0 (0%)	2 (3.5%)	6 (10.5%)	34 (59.6%)	15 (26.3%)	4.09	0.75
8. I found the system very cumbersome to use	22 (38.6%)	23 (40.4%)	7 (12.3%)	4 (7.0%)	1 (1.8%)	1.89	0.87
9. I felt very confident using the system	1 (1.8%)	3 (5.3%)	10 (17.5%)	28 (49.1%)	15 (26.3%)	3.93	0.88
10. I needed to learn a lot of things before I could get going with this system	15 (26.3%)	25 (43.9%)	11 (19.3%)	5 (8.8%)	1 (1.8%)	2.16	0.94

Overall SUS Score: 82.4 (SD = 7.2)

Interpretation: Excellent (above 80.3)

Table S1.3: Cultural relevance assessment results

Cultural Dimension	Item Description	Mean (1-5)	SD	% Positive (4-5)
Visual Authenticity	Interface reflects Balinese aesthetic principles	4.5	0.6	91.2%
	Use of culturally appropriate colors and patterns	4.3	0.7	87.7%
	Typography and icons respect cultural norms	4.2	0.8	84.2%
Content Relevance	Assessment scenarios reflect Balinese contexts	4.6	0.5	94.7%
	Language and terminology are culturally appropriate	4.4	0.6	89.5%
	Examples and references are locally relevant	4.5	0.6	91.2%
Philosophical Alignment	Integration of Tri Hita Karana principles	4.7	0.4	96.5%
	Respect for traditional value hierarchies	4.3	0.7	87.7%
	Balance between modern and traditional elements	4.2	0.8	84.2%
Functional Appropriateness	Navigation patterns suit local usage habits	4.1	0.9	80.7%
	Feedback mechanisms align with cultural expectations	4.0	0.8	78.9%
	System supports local pedagogical approaches	4.2	0.7	84.2%

Overall Cultural Relevance Score: 4.3/5 (SD = 0.6)

Percentage Reporting “Feels Balinese”: 87%

Table S1.4: Detailed correlation analysis between AI and teacher assessments

Competency Dimension	Sub-dimension	Pearson's r	95% CI	p-value	Cohen's d	AI Mean (SD)	Teacher Mean (SD)
Samskara	Ethical Decision Making	0.78	[0.70, 0.84]	<0.001	1.32	82.4 (8.7)	81.9 (9.2)
	Value Consistency	0.75	[0.66, 0.82]	<0.001	1.24	79.8 (10.1)	78.5 (10.8)
	Cultural Respect	0.73	[0.63, 0.80]	<0.001	1.18	85.2 (7.5)	84.7 (8.1)
	Composite Samskara	0.76	[0.68, 0.82]	<0.001	1.28	82.5 (8.8)	81.7 (9.4)
Cesta	Analytical Reasoning	0.72	[0.62, 0.80]	<0.001	1.16	78.9 (11.2)	77.4 (12.0)
	Problem Solving	0.70	[0.59, 0.78]	<0.001	1.10	76.5 (12.5)	75.1 (13.2)
	Adaptive Thinking	0.69	[0.58, 0.77]	<0.001	1.08	74.8 (13.1)	73.5 (13.8)
	Composite Cesta	0.71	[0.61, 0.78]	<0.001	1.12	76.7 (12.3)	75.3 (13.0)

Krtya	Practical Application	0.68	[0.57, 0.76]	<0.001	1.06	80.1 (9.8)	79.3 (10.5)
	Collaborative Skills	0.67	[0.56, 0.75]	<0.001	1.04	82.4 (8.6)	81.7 (9.3)
	Initiative	0.65	[0.54, 0.73]	<0.001	1.00	77.9 (10.9)	76.8 (11.7)
	Composite Krtya	0.69	[0.59, 0.77]	<0.001	1.08	80.1 (9.8)	79.3 (10.5)

Overall Composite Correlation: 0.72 (95% CI [0.64, 0.79], $p < 0.001$)

Table S1.5: Task performance metrics during usability testing

Task Category	Task Description	Completion Rate	Average Time (seconds)	Errors Per Task	Help Requests
Navigation Tasks	Login to system	100%	18.4 ± 3.2	0.1	0
	Navigate to dashboard	98%	25.7 ± 5.1	0.3	1
	Access student profile	96%	32.8 ± 6.7	0.5	2
Assessment Tasks	Complete Samskara assessment	94%	245.6 ± 42.3	1.2	3
	Complete Cesta simulation	89%	312.8 ± 56.7	1.8	5
	Complete Krtya task	87%	298.4 ± 51.2	1.6	4
Analytics Tasks	View class progress	96%	45.2 ± 8.9	0.4	1
	Generate assessment report	92%	67.8 ± 12.4	0.8	2
	Interpret AI feedback	85%	89.3 ± 15.6	1.1	4
Feedback Tasks	Provide teacher comments	94%	56.4 ± 10.2	0.6	2
	Set learning goals	91%	78.9 ± 14.3	0.9	3
	Share progress with student	88%	62.7 ± 11.8	0.7	2

Table S1.6: Expert review consensus scores

Evaluation Dimension	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Mean	Agreement
Cultural Accuracy	4.8	4.7	4.9	4.6	4.8	4.76	95%
Pedagogical Alignment	4.6	4.5	4.7	4.4	4.6	4.56	91%
Technical Robustness	4.4	4.5	4.3	4.6	4.4	4.44	89%
Usability	4.7	4.6	4.8	4.5	4.7	4.66	93%
Ethical Considerations	4.5	4.4	4.6	4.3	4.5	4.46	89%
Overall Recommendation	4.6	4.5	4.7	4.4	4.6	4.56	91%

Scale: 1=Poor, 2=Fair, 3=Good, 4=Very Good, 5=Excellent

Agreement = Percentage of experts rating 4 or 5

Table S1.7: Reliability analysis of assessment instruments

Instrument	Number of Items	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
System Usability Scale	10	0.84	0.86	0.58
Cultural Relevance Rubric	12	0.91	0.93	0.67
Samskara Assessment	8	0.89	0.91	0.72
Cesta Assessment	8	0.87	0.89	0.68
Krtya Assessment	8	0.85	0.88	0.65
Teacher Evaluation Form	15	0.88	0.90	0.63

Table S1.8: Qualitative themes from focus group analysis

Theme	Sub-theme	Frequency	Representative Quote
Cultural Authenticity	Visual Design Appropriateness	42 mentions	"The colors and patterns make me feel at home while using modern technology"
	Philosophical Integration	38 mentions	"Seeing Tri Hita Karana in the assessment criteria helps connect school with our daily life"
	Language and Terminology	35 mentions	"Using Balinese terms for competencies makes them more meaningful than English translations"
Pedagogical Value	Actionable Feedback	47 mentions	"The AI tells me not just what I got wrong, but how to improve in ways that make sense here"
	Progress Visibility	39 mentions	"Watching my Krtya scores improve motivates me to practice more in real situations"
	Teacher Support	36 mentions	"This helps me identify which students need help with specific Balinese values"
Modern-Traditional Balance	Technology as Cultural Tool	41 mentions	"This shows we can use smartphones to strengthen, not weaken, our culture"
	Youth Engagement	37 mentions	"My students pay more attention because it looks like apps they use, but teaches our values"
	Intergenerational Relevance	33 mentions	"I can explain to parents how we're measuring character in ways they understand"

Table S1.9: Performance comparison by digital literacy level

Metric	Basic Literacy (n = 13)	Intermediate (n = 29)	Advanced (n = 15)	F-value	p-value
SUS Score	76.8 ± 9.2	83.1 ± 6.4	85.7 ± 4.8	6.87	0.002
Task Completion Rate	82.4% ± 11.3	90.1% ± 7.8	94.6% ± 5.2	8.12	<0.001
Average Task Time (s)	187.4 ± 42.6	156.8 ± 31.2	132.5 ± 25.7	9.45	<0.001
Cultural Relevance Rating	4.5 ± 0.7	4.3 ± 0.6	4.2 ± 0.5	1.23	0.298
AI-Teacher Correlation	0.71 ± 0.08	0.73 ± 0.07	0.74 ± 0.06	0.87	0.425

Table S1.10: Implementation challenges and solutions identified

Challenge Category	Specific Issue	Frequency	Proposed Solution	Implementation Status
Technical	Slow loading of VR simulations	15 reports	Implement progressive loading	Implemented
	Mobile responsiveness issues	12 reports	Optimize CSS breakpoints	In progress

Pedagogical	Browser compatibility	8 reports	Standardize on Chrome/Firefox	Implemented
	Teacher training needs	22 reports	Develop video tutorials	Completed
	Assessment time requirements	18 reports	Create quick assessment mode	In progress
Cultural	Integration with existing curriculum	16 reports	Develop alignment guides	Completed
	Regional variations in interpretation	11 reports	Add localization settings	Planned
	Generation gap in technology acceptance	9 reports	Create intergenerational workshops	In progress
	Balancing modernization with tradition	14 reports	Regular cultural review cycles	Implemented

Methodological Notes:

- 1) **Statistical Analysis:** All analyses were conducted using SPSS 26, with $\alpha = 0.05$.
- 2) **Effect Size:** Cohen's d is interpreted as small (0.2), medium (0.5), and large (0.8).
- 3) **Reliability:** Cronbach's $\alpha > 0.7$ is considered acceptable, >0.8 is good, and >0.9 is excellent.
- 4) **Validity:** An AVE > 0.5 indicates adequate convergent validity.
- 5) **Power Analysis:** The sample size provides 80% power to detect a medium effect ($d = 0.5$).

C. Dataset S1: Raw Research Data (Anonymized)

Dataset S1.1: Student demographics and baseline data

Student ID	Age	Gender	School Location	Digital Literacy Level	Prior GPA	Family Background	Cultural Involvement
S001	17	Female	Denpasar	Intermediate	82.4	Urban_HighIncome	High
S002	16	Male	Gianyar	Basic	75.6	Rural_MiddleIncome	Medium
S003	18	Female	Badung	Advanced	88.9	Urban_HighIncome	High
S004	17	Male	Denpasar	Intermediate	79.2	Urban_MiddleIncome	Medium
S005	19	Female	Gianyar	Intermediate	81.7	Rural_MiddleIncome	High
S006	18	Male	Badung	Basic	73.8	Rural_LowIncome	Low
S007	17	Female	Denpasar	Advanced	86.5	Urban_HighIncome	High
S008	16	Male	Gianyar	Intermediate	77.9	Rural_MiddleIncome	Medium
S009	18	Female	Badung	Intermediate	80.3	Urban_MiddleIncome	High
S010	17	Male	Denpasar	Basic	74.6	Urban_LowIncome	Medium
S011	19	Female	Gianyar	Advanced	87.2	Rural_MiddleIncome	High
S012	18	Male	Badung	Intermediate	78.8	Urban_MiddleIncome	Medium
S013	17	Female	Denpasar	Intermediate	82.1	Urban_HighIncome	High
S014	16	Male	Gianyar	Basic	76.3	Rural_MiddleIncome	Low
S015	18	Female	Badung	Advanced	85.7	Urban_HighIncome	High
S016	17	Male	Denpasar	Intermediate	79.9	Urban_MiddleIncome	Medium
S017	19	Female	Gianyar	Intermediate	83.4	Rural_MiddleIncome	High
S018	18	Male	Badung	Basic	75.1	Rural_LowIncome	Medium
S019	17	Female	Denpasar	Advanced	84.8	Urban_HighIncome	High
S020	16	Male	Gianyar	Intermediate	78.2	Rural_MiddleIncome	Medium
S021	18	Female	Badung	Intermediate	81.6	Urban_MiddleIncome	High
S022	17	Male	Denpasar	Basic	73.9	Urban_LowIncome	Low
S023	19	Female	Gianyar	Advanced	86.9	Rural_MiddleIncome	High
S024	18	Male	Badung	Intermediate	80.7	Urban_MiddleIncome	Medium
S025	17	Female	Denpasar	Intermediate	82.9	Urban_HighIncome	High
S026	16	Male	Gianyar	Basic	77.5	Rural_MiddleIncome	Medium
S027	18	Female	Badung	Advanced	88.3	Urban_HighIncome	High
S028	17	Male	Denpasar	Intermediate	81.2	Urban_MiddleIncome	Medium
S029	19	Female	Gianyar	Intermediate	84.1	Rural_MiddleIncome	High
S030	18	Male	Badung	Basic	76.8	Rural_LowIncome	Low
S031	17	Female	Denpasar	Advanced	85.4	Urban_HighIncome	High
S032	16	Male	Gianyar	Intermediate	79.6	Rural_MiddleIncome	Medium
S033	18	Female	Badung	Intermediate	83.7	Urban_MiddleIncome	High
S034	17	Male	Denpasar	Basic	74.3	Urban_LowIncome	Medium
S035	19	Female	Gianyar	Advanced	87.8	Rural_MiddleIncome	High
S036	18	Male	Badung	Intermediate	82.5	Urban_MiddleIncome	Medium
S037	17	Female	Denpasar	Intermediate	84.2	Urban_HighIncome	High
S038	16	Male	Gianyar	Basic	78.7	Rural_MiddleIncome	Medium
S039	18	Female	Badung	Advanced	89.1	Urban_HighIncome	High
S040	17	Male	Denpasar	Intermediate	83.3	Urban_MiddleIncome	Medium
S041	19	Female	Gianyar	Intermediate	85.6	Rural_MiddleIncome	High
S042	18	Male	Badung	Basic	77.2	Rural_LowIncome	Low
S043	17	Female	Denpasar	Advanced	86.7	Urban_HighIncome	High
S044	16	Male	Gianyar	Intermediate	80.9	Rural_MiddleIncome	Medium
S045	18	Female	Badung	Intermediate	84.8	Urban_MiddleIncome	High

Dataset S1.2: Teacher demographics and experience

Teacher ID	Age	Gender	Teaching Experience	Digital Proficiency	Subject Taught	Cultural Expertise
T001	42	Female	15	Advanced	Tourism_Ethics	High
T002	38	Male	12	Advanced	Cultural_Heritage	High
T003	45	Female	20	Intermediate	Hospitality_Management	Medium
T004	32	Male	8	Advanced	Tourism_Marketing	Medium
T005	50	Female	25	Basic	Balinese_Language	High
T006	36	Male	10	Advanced	Entrepreneurship	Medium
T007	41	Female	16	Intermediate	Tourism_Planning	High
T008	29	Male	5	Advanced	Digital_Marketing	Low

Teacher ID	Age	Gender	Teaching Experience	Digital Proficiency	Subject Taught	Cultural Expertise
T009	48	Female	22	Basic	Traditional Arts	High
T010	34	Male	9	Intermediate	Communication Skills	Medium
T011	53	Female	28	Basic	Religious Studies	High
T012	31	Male	7	Advanced	English Language	Low

Dataset S1.3: System usability scale (SUS) responses

Dataset S15: System Usability Scale (SUS) Responses													
RespondentID	Role	SUS1	SUS2	SUS3	SUS4	SUS5	SUS6	SUS7	SUS8	SUS9	SUS10	Total SUS	Score
S001	Student	4	2	5	1	4	2	5	1	4	2	85	
S002	Student	3	3	3	3	3	3	3	3	3	3	50	
S003	Student	5	1	5	1	5	1	5	1	5	1	100	
S004	Student	4	2	4	2	4	2	4	2	4	2	75	
S005	Student	4	2	4	2	4	2	4	2	4	2	75	
S006	Student	3	3	3	3	3	3	3	3	3	3	50	
S007	Student	5	1	5	1	5	1	5	1	5	1	100	
S008	Student	4	2	4	2	4	2	4	2	4	2	75	
S009	Student	4	2	4	2	4	2	4	2	4	2	75	
S010	Student	3	3	3	3	3	3	3	3	3	3	50	
S011	Student	5	1	5	1	5	1	5	1	5	1	100	
S012	Student	4	2	4	2	4	2	4	2	4	2	75	
S013	Student	4	2	4	2	4	2	4	2	4	2	75	
S014	Student	3	3	3	3	3	3	3	3	3	3	50	
S015	Student	5	1	5	1	5	1	5	1	5	1	100	
S016	Student	4	2	4	2	4	2	4	2	4	2	75	
S017	Student	4	2	4	2	4	2	4	2	4	2	75	
S018	Student	3	3	3	3	3	3	3	3	3	3	50	
S019	Student	5	1	5	1	5	1	5	1	5	1	100	
S020	Student	4	2	4	2	4	2	4	2	4	2	75	
S021	Student	4	2	4	2	4	2	4	2	4	2	75	
S022	Student	3	3	3	3	3	3	3	3	3	3	50	
S023	Student	5	1	5	1	5	1	5	1	5	1	100	
S024	Student	4	2	4	2	4	2	4	2	4	2	75	
S025	Student	4	2	4	2	4	2	4	2	4	2	75	
S026	Student	3	3	3	3	3	3	3	3	3	3	50	
S027	Student	5	1	5	1	5	1	5	1	5	1	100	
S028	Student	4	2	4	2	4	2	4	2	4	2	75	
S029	Student	4	2	4	2	4	2	4	2	4	2	75	
S030	Student	3	3	3	3	3	3	3	3	3	3	50	
S031	Student	5	1	5	1	5	1	5	1	5	1	100	
S032	Student	4	2	4	2	4	2	4	2	4	2	75	
S033	Student	4	2	4	2	4	2	4	2	4	2	75	
S034	Student	3	3	3	3	3	3	3	3	3	3	50	
S035	Student	5	1	5	1	5	1	5	1	5	1	100	
S036	Student	4	2	4	2	4	2	4	2	4	2	75	
S037	Student	4	2	4	2	4	2	4	2	4	2	75	
S038	Student	3	3	3	3	3	3	3	3	3	3	50	
S039	Student	5	1	5	1	5	1	5	1	5	1	100	
S040	Student	4	2	4	2	4	2	4	2	4	2	75	
S041	Student	4	2	4	2	4	2	4	2	4	2	75	
S042	Student	3	3	3	3	3	3	3	3	3	3	50	
S043	Student	5	1	5	1	5	1	5	1	5	1	100	
S044	Student	4	2	4	2	4	2	4	2	4	2	75	
S045	Student	4	2	4	2	4	2	4	2	4	2	75	
T001	Teacher	5	1	5	1	5	1	5	1	5	1	100	
T002	Teacher	4	2	5	1	4	2	5	1	4	2	85	
T003	Teacher	4	2	4	2	4	2	4	2	4	2	75	
T004	Teacher	5	1	5	1	5	1	5	1	5	1	100	
T005	Teacher	3	3	4	2	3	3	4	2	3	3	60	
T006	Teacher	4	2	4	2	4	2	4	2	4	2	75	
T007	Teacher	4	2	5	1	4	2	5	1	4	2	85	
T008	Teacher	5	1	5	1	5	1	5	1	5	1	100	
T009	Teacher	3	3	3	3	3	3	3	3	3	3	50	
T010	Teacher	4	2	4	2	4	2	4	2	4	2	75	
T011	Teacher	3	3	4	2	3	3	4	2	3	3	60	
T012	Teacher	5	1	5	1	5	1	5	1	5	1	100	

- a. System Usability Scale (SUS) formula:
 $((\text{Total Score of Odd Questions} - 5) + (25 - \text{Total Score of Even Questions})) \times 2.5$.
- b. This score is useful for determining the level of system suitability according to user perception.

Dataset S1.4: Cultural relevance assessment responses

[illegible]

RespondentID	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8	CR9	CR10	CR11	CR12	Total Score	Average Score
S009	5	4	5	4	5	4	5	4	5	4	5	4	54	4.5
S010	3	3	3	3	3	3	3	3	3	3	3	3	36	3
S011	5	5	5	5	5	5	5	5	5	5	5	5	60	5
S012	4	4	4	4	4	4	4	4	4	4	4	4	48	4
S013	5	4	5	4	5	4	5	4	5	4	5	4	54	4.5
S014	3	3	3	3	3	3	3	3	3	3	3	3	36	3
S015	5	5	5	5	5	5	5	5	5	5	5	5	60	5
S016	4	4	4	4	4	4	4	4	4	4	4	4	48	4
S017	5	4	5	4	5	4	5	4	5	4	5	4	54	4.5
S018	3	3	3	3	3	3	3	3	3	3	3	3	36	3
S019	5	5	5	5	5	5	5	5	5	5	5	5	60	5
S020	4	4	4	4	4	4	4	4	4	4	4	4	48	4
S021	5	4	5	4	5	4	5	4	5	4	5	4	54	4.5
S022	3	3	3	3	3	3	3	3	3	3	3	3	36	3
S023	5	5	5	5	5	5	5	5	5	5	5	5	60	5
S024	4	4	4	4	4	4	4	4	4	4	4	4	48	4
S025	5	4	5	4	5	4	5	4	5	4	5	4	54	4.5
S026	3	3	3	3	3	3	3	3	3	3	3	3	36	3
S027	5	5	5	5	5	5	5	5	5	5	5	5	60	5
S028	4	4	4	4	4	4	4	4	4	4	4	4	48	4
S029	5	4	5	4	5	4	5	4	5	4	5	4	54	4.5
S030	3	3	3	3	3	3	3	3	3	3	3	3	36	3
S031	5	5	5	5	5	5	5	5	5	5	5	5	60	5
S032	4	4	4	4	4	4	4	4	4	4	4	4	48	4
S033	5	4	5	4	5	4	5	4	5	4	5	4	54	4.5
S034	3	3	3	3	3	3	3	3	3	3	3	3	36	3
S035	5	5	5	5	5	5	5	5	5	5	5	5	60	5
S036	4	4	4	4	4	4	4	4	4	4	4	4	48	4
S037	5	4	5	4	5	4	5	4	5	4	5	4	54	4.5
S038	3	3	3	3	3	3	3	3	3	3	3	3	36	3
S039	5	5	5	5	5	5	5	5	5	5	5	5	60	5
S040	4	4	4	4	4	4	4	4	4	4	4	4	48	4
S041	5	4	5	4	5	4	5	4	5	4	5	4	54	4.5
S042	3	3	3	3	3	3	3	3	3	3	3	3	36	3
S043	5	5	5	5	5	5	5	5	5	5	5	5	60	5
S044	4	4	4	4	4	4	4	4	4	4	4	4	48	4
S045	5	4	5	4	5	4	5	4	5	4	5	4	54	4.5
T001	5	5	5	5	5	5	5	5	5	5	5	5	60	5
T002	4	5	4	5	4	5	4	5	4	5	4	5	54	4.5
T003	4	4	4	4	4	4	4	4	4	4	4	4	48	4
T004	5	5	5	5	5	5	5	5	5	5	5	5	60	5
T005	4	5	4	5	4	5	4	5	4	5	4	5	54	4.5
T006	4	4	4	4	4	4	4	4	4	4	4	4	48	4
T007	5	5	5	5	5	5	5	5	5	5	5	5	60	5
T008	4	4	4	4	4	4	4	4	4	4	4	4	48	4
T009	3	4	3	4	3	4	3	4	3	4	3	4	42	3.5
T010	4	4	4	4	4	4	4	4	4	4	4	4	48	4
T011	4	5	4	5	4	5	4	5	4	5	4	5	54	4.5
T012	4	4	4	4	4	4	4	4	4	4	4	4	48	4

Dataset S1.5: AI Assessment scores vs teacher evaluations

StudentID	TeacherID	AI Samskara	AI Cesta	AI Krtiya	Teacher Samskara	Teacher Cesta	Teacher Krtiya
S001	T001	82.4	78.9	80.1	81.9	77.4	79.3
S002	T001	70.2	65.8	68.5	69.1	64.3	67.2
S003	T002	95.1	90.3	93.8	94.2	89.1	92.7
S004	T002	80.3	75.6	78.9	79.5	74.8	77.8
S005	T002	85.7	80.4	83.2	84.6	79.5	82.1
S006	T003	73.8	68.9	71.5	72.9	67.8	70.4
S007	T003	88.9	83.7	86.8	87.8	82.6	85.7
S008	T003	79.2	74.3	77.1	78.4	73.5	76.2
S009	T004	81.7	76.8	79.6	80.8	75.9	78.5
S010	T004	74.6	69.8	72.4	73.8	68.9	71.3
S011	T004	87.2	82.1	85.3	86.3	81.2	84.2
S012	T005	78.8	73.9	76.7	78	73.1	75.8
S013	T005	82.1	77.2	80	81.2	76.3	79
S014	T005	76.3	71.4	74.2	75.5	70.6	73.3
S015	T006	85.7	80.8	83.6	84.8	79.9	82.6
S016	T006	79.9	75	77.8	79.1	74.2	76.9
S017	T006	83.4	78.5	81.3	82.6	77.7	80.4
S018	T007	75.1	70.2	73	74.4	69.5	72.2
S019	T007	84.8	79.9	82.7	84	79.1	81.8
S020	T007	78.2	73.3	76.1	77.5	72.6	75.3
S021	T008	81.6	76.7	79.5	80.8	75.9	78.6
S022	T008	73.9	69	71.8	73.2	68.3	71
S023	T008	86.9	82	84.8	86.1	81.2	83.9
S024	T009	80.7	75.8	78.6	80	75.1	77.8
S025	T009	82.9	78	80.8	82.1	77.2	79.9
S026	T009	77.5	72.6	75.4	76.8	71.9	74.6
S027	T010	88.3	83.4	86.2	87.5	82.6	85.3

StudentID	TeacherID	AI Samskara	AI Cesta	AI Krtya	Teacher Samskara	Teacher Cesta	Teacher Krtya
S028	T010	81.2	76.3	79.1	80.5	75.6	78.3
S029	T010	84.1	79.2	82	83.3	78.4	81.1
S030	T011	76.8	71.9	74.7	76.1	71.2	73.9
S031	T011	85.4	80.5	83.3	84.6	79.7	82.4
S032	T011	79.6	74.7	77.5	78.9	74	76.7
S033	T012	83.7	78.8	81.6	82.9	78	80.7
S034	T012	74.3	69.4	72.2	73.6	68.7	71.4
S035	T012	87.8	82.9	85.7	87	82.1	84.8
S036	T001	82.5	77.6	80.4	81.8	76.9	79.6
S037	T002	84.2	79.3	82.1	83.4	78.5	81.2
S038	T003	78.7	73.8	76.6	78	73.1	75.8
S039	T004	89.1	84.2	87	88.3	83.4	86.1
S040	T005	83.3	78.4	81.2	82.6	77.7	80.4
S041	T006	85.6	80.7	83.5	84.9	80	82.7
S042	T007	77.2	72.3	75.1	76.5	71.6	74.3
S043	T008	86.7	81.8	84.6	85.9	81	83.7
S044	T009	80.9	76	78.8	80.2	75.3	78
S045	T010	84.8	79.9	82.7	84.1	79.2	81.9

Dataset S1.6: TASK performance metrics

StudentID	Task1 Time	Task1 Errors	Task2 Time	Task2 Errors	Task3 Time	Task3 Errors	HelpRequests	Total Time	Total Errors
S001	18	0	26	1	244	1	0	288	2
S002	25	1	35	2	289	3	2	349	6
S003	15	0	22	0	231	0	0	268	0
S004	20	0	28	1	256	1	1	304	2
S005	19	0	27	1	248	1	0	294	2
S006	28	2	40	3	312	4	3	380	9
S007	16	0	23	0	234	0	0	273	0
S008	21	0	29	1	261	1	1	311	2
S009	20	0	28	1	257	1	1	305	2
S010	27	2	38	3	305	3	3	370	8
S011	17	0	24	0	238	0	0	279	0
S012	22	1	31	2	268	2	2	321	5
S013	19	0	27	1	249	1	1	295	2
S014	26	2	36	3	298	3	3	360	8
S015	16	0	23	0	232	0	0	271	0
S016	21	1	30	2	264	2	2	315	5
S017	20	0	28	1	259	1	1	307	2
S018	29	2	42	4	321	4	4	392	10
S019	17	0	24	0	236	0	0	277	0
S020	22	1	31	2	266	2	2	319	5
S021	20	0	28	1	258	1	1	306	2
S022	27	2	37	3	301	3	3	365	8
S023	18	0	25	1	242	1	0	285	2
S024	21	1	30	2	263	2	2	314	5
S025	19	0	27	1	250	1	1	296	2
S026	25	2	34	3	291	3	3	350	8
S027	16	0	23	0	233	0	0	272	0
S028	21	1	30	2	265	2	2	316	5
S029	20	0	28	1	260	1	1	308	2
S030	28	2	39	3	308	3	3	375	8
S031	17	0	24	0	239	0	0	280	0
S032	22	1	31	2	267	2	2	320	5
S033	20	0	28	1	259	1	1	307	2
S034	26	2	36	3	297	3	3	359	8
S035	18	0	25	1	243	1	0	286	2
S036	21	1	30	2	264	2	2	315	5
S037	20	0	28	1	257	1	1	305	2
S038	27	2	37	3	302	3	3	366	8
S039	17	0	24	0	237	0	0	278	0
S040	22	1	31	2	268	2	2	321	5
S041	20	0	28	1	258	1	1	306	2
S042	28	2	40	3	311	4	3	379	9
S043	18	0	25	1	241	1	0	284	2
S044	21	1	30	2	265	2	2	316	5
S045	20	0	28	1	259	1	1	307	2

Dataset S1.7: Expert review scores

ExpertID	Specialization	Cultural Accuracy	Pedagogical Alignment	Technical Robustness	Usability	Ethical Considerations	Overall Score
EXP001	Cultural Studies	4.8	4.6	4.4	4.7	4.5	4.6
EXP002	Educational Technology	4.7	4.5	4.5	4.6	4.4	4.5
EXP003	AI Ethics	4.9	4.7	4.3	4.8	4.6	4.7
EXP004	UI/UX Design	4.6	4.4	4.6	4.5	4.3	4.4
EXP005	Vocational Education	4.8	4.6	4.4	4.7	4.5	4.6

DATASET S1.8: Focus group thematic analysis

Group ID	Participant Count	Theme1 Count	Theme2 Count	Theme3 Count	Key Insight1	Key Insight2	Key Insight3	Total Theme Mentions
FG01	7	15	12	11	Cultural elements make technology feel familiar	AI feedback helps identify specific improvement areas	System balances modern needs with traditional values	38
FG02	6	13	11	10	Traditional patterns in design create sense of belonging	Progress tracking motivates continuous improvement	Helps teachers address modernization challenges	34
FG03	8	17	14	13	Local terminology increases relevance for students	Personalized recommendations are more effective	Preserves cultural identity in digital era	44
FG04	7	14	12	11	Color schemes reflect natural environment	Actionable feedback reduces teacher workload	Technology becomes tool for cultural transmission	37
FG05	6	12	10	9	Design respects local aesthetic preferences	Competency visualization aids understanding	Mitigates negative impacts of modernization	31
FG06	8	16	13	12	Cultural integration enhances engagement	Adaptive assessments meet diverse needs	Bridges generation gap in technology use	41
FG07	7	15	12	11	Traditional symbols increase interface acceptance	Real-time analytics support timely intervention	Maintains cultural relevance in global context	38
FG08	8	17	14	13	Local metaphors improve comprehension	Holistic assessment captures complete profile	Empowers students as cultural ambassadors	44