ИНФОРМАЦИОННЫЕ ТЕХНОЛОГИИ В ОБРАЗОВАНИИ

Оригинальная статья / Original paper

doi:10.17853/1994-5639-2026-2-166-190

The impact of dynamic feedback on AI tutor performance

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Abstract*. Introduction.* Behavioural adaptive AI systems demonstrate significant potential in providing timely learning support. However, a key aspect of their operation, dynamically switching behavioural patterns based on real-time analysis of streaming data from learners, remains an area requiring further research. *Aim.* The *aim* of this study is to assess the impact of a transparent switching policy, based on sentiment and response latency, on student engagement, trust, and academic outcomes, as well as to examine its effect on response latency and expressed sentiment. *Methodology and research methods.* The authors conducted a randomised, real-world study involving 80 students during a 45-minute session. The experiment compared a dynamic-persona tutor with a fixed-persona baseline tutor. To evaluate the results, the following measures were used: a five-item engagement scale, a five-item trust scale, a curriculum-aligned ten-item pre- and post-knowledge test, log-level tutor-to-learner response latency, and message-level sentiment analysis mapped by a transformer classifier onto a polarity scale ranging from -1 to +1. The role-change algorithm operated as follows: if the rolling mean of sentiment was at or below -0.30, the tutor adopted the role of Empathic Coach; if response latency exceeded ten seconds, the tutor assumed the role of Rational Guide; in all other cases, the tutor remained a Neutral Instructor. Following a role change, there was a one-turn "cooldown" period, and a return to the neutral role occurred after two consecutive stable interactions. *Results and scientific novelty.* The authors developed a testable role-switching algorithm that selects the optimal interaction strategy in real-time by analysing the learner's emotional state and response latency. The efficacy of this approach was confirmed in a real-world educational setting. *Practical significance.* This approach provides a ready-made solution for implementing adaptive learning in real-world educational settings. Its advantages include simple rules, low computational costs, and a transparent auditing system.

Keywords: intelligent tutoring systems, dynamic persona switching, affective computing, sentiment analysis, response latency, learner engagement, trust in automation, learning outcomes

For citation: El Gounidi R., Chafiq N., Ghazouani M., Moundy K., Chaouki A. The impact of dynamic feedback on AI tutor performance. *Obrazovanie i nauka = The Education and Science Journal*. 2026;28(2):166–190. doi:10.17853/1994-5639-2026-2-166-190

Влияние динамической обратной связи на эффективность ИИ-тьютора

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Аннотация. *Введение.* Поведенчески-адаптивные системы искусственного интеллекта демонстрируют потенциал в обеспечении своевременной учебной поддержки. Тем не менее ключевой аспект их функционирования – динамическое переключение поведенческих моделей на основе анализа потоковых данных от учащихся в реальном времени – остается областью, требующей дальнейшего исследования. *Целью* данного исследования является оценка влияния прозрачной политики переключения, основанной на анализе тональности высказываний и времени ответа, на вовлеченность, доверие и академические результаты учащихся, а также изучение ее воздействия на временные параметры ответов и эмоциональную тональность коммуникации. *Методология, методы и методики.* Авторы провели рандомизированное исследование в условиях реального учебного процесса с участием 80 студентов в рамках 45-минутного занятия. В ходе эксперимента сравнивался тьютор с динамической сменой ролей и базовый тьютор с фиксированной ролью. Для оценки результатов использовались: пятибалльная шкала вовлечённости, пятибалльная шкала доверия, десятибалльный предметный тест до и после обучения, время ответа системы на уровне логов, а также тональность каждого сообщения, определяемая трансформерным классификатором по шкале от -1 до +1. Алгоритм смены ролей был следующим: при скользящем среднем значении тональности ⩽ -0,30 тьютор переключался в роль «Эмпатичный наставник»; при времени ответа > 10 секунд активировалась роль «Рациональный гид»; в остальных случаях сохранялась роль «Нейтральный инструктор». После смены роли действовал период «охлаждения» длиной в один ход, а возврат к нейтральной роли происходил после двух последовательных стабильных ходов. *Результаты и научная новизна.* Авторы предложили проверяемый алгоритм переключения ролей, который сочетает анализ эмоционального состояния обучающегося и времени его реакции для выбора оптимальной стратегии взаимодействия в реальном времени. Эффективность данного подхода была подтверждена в условиях реального учебного процесса. *Практическая значимость.* Данный подход представляет собой готовое решение для внедрения адаптивного обучения в условиях реального учебного процессах. Его преимущества – простые правила, низкие вычислительные затраты и прозрачная система аудита.

Ключевые слова: интеллектуальные системы обучения, динамическое переключение личностей, аффективные вычисления, анализ тональности текста, время отклика, вовлеченность учащихся, доверие к автоматизации, результаты обучения

Для цитирования: Эль-Гуниди Р., Шафик Н., Газуани М., Мунди К., Чауки А. Влияние динамической обратной связи на эффективность ИИ-тьютора. *Образование и наука.* 2026;28(2):166–190. doi:10.17853/1994-5639-2026-2-166-190

Introduction

In contemporary education, AI-enhanced approaches are reshaping learning to be more personalised, interactive and learner-centred. A. M. Lacárcel [1] highlights how artificial intelligence in education enables individualisation of content and pacing across subjects, while R. Khazanchi and P. Khazanchi [2] describe intelligent tutoring systems (ITS) that diagnose learner states and deliver targeted support at scale. Building on these foundations, W. Kim and J.-H. Kim [3] point to large language models (LLMs) as a catalyst for classroom-ready, context-aware explanations and examples that approximate human tutoring dialogue. Yet, as R. Kokku, S. Sundararajan, P. Dey et al. [4] note, many classroom deployments still privilege content adaptation over interactional nuance, leaving the voice of the tutor largely static and didactic.

A complementary line of work examines how AI tutors communicate, not only what they say. A. Karahasanovic, A. Følstad and P. Schittekat [5] propose personas to "put a face on algorithms", arguing that stance and tone help shape perceived warmth and credibility. A. Drobnjak, I. Boticki, P. Seow et al. [6] review persona-driven conversational agents and report motivational and persistence benefits when interaction styles feel human-like and responsive. In higher-education case studies, practical deployments of AI tutors have likewise documented improvements in motivation and study behaviours when style aligns with learner needs [7–13]. From an engagement perspective, sustained behavioural, emotional and cognitive investment is sensitive to social presence cues [14], and trust research underscores that appropriate, transparent responses are central to calibrated reliance on AI guidance [15].

Operationalising style adaptation in everyday classrooms is increasingly feasible without specialised sensors. D. Gomes [16] surveys advances in adaptive platforms, while W. Gan, Y. Sun, S. Ye et al. [17] demonstrate the value of lightweight analytics for tailoring question design and feedback. In ordinary chat interfaces, two signals are readily available in real time: message-level sentiment as an affective proxy (frustration versus confidence) and turn-level response latency as a behavioural indicator of hesitation or overload [16–19]. With prompt conditioning, a single LLM can project distinct, repeatable persona, such as an empathic coach, a neutral instructor or a rational, stepwise guide, while holding content accuracy constant [20]. This combination suggests a pragmatic path to behaviour-aware persona switching that schools could adopt within existing infrastructure.

Despite this promise, three gaps persist in literature. First, most adaptive tutors emphasise knowledge tracing or difficulty control and under-specify policies that

jointly fuse affective and behavioural signals for decision-making. Second, when persona switching is attempted, thresholds and rules are often opaque or tuned ad hoc, which limits auditability and classroom uptake [21, 8]. Third, there are relatively few classroom evaluations that consider multiple outcomes, engagement, trust, learning, and process speed, beyond test accuracy alone. Calls to humanise AI in education and to design caring, explainable assessment further emphasise the need for transparent, auditable triggers that teachers can understand and refine.

This study evaluates a behaviour-aware AI tutor that alternates among three personae, Empathic Coach, Neutral Instructor and Rational Guide, under a transparent rule that combines a rolling sentiment estimate with a latency threshold. The aim is to determine whether such persona switching improves learner experience and outcomes relative to a fixed-persona baseline. We ask: RQ1 (Engagement): does dynamic persona switching increase learner engagement during a lesson? RQ2 (Trust): does it increase trust in the tutor's suggestions and feedback? RQ3 (Learning): does it yield higher post-test performance when controlling pre-test? RQ4 (Process): does it reduce tutor-learner response latency without adverse effects on average expressed sentiment?

Guided by prior work on social presence, affect-aware tutoring and appropriate reliance on automation, we hypothesise positive effects on engagement and trust, a moderate improvement in learning within a session, and a substantial reduction in response latency, with no reliable difference in average sentiment across groups [7, 6, 12–15]. Our contribution is a simple, fully specified and auditable switching policy implementable with standard chat logs, evaluated through a randomised classroom comparison and a multidimensional outcome set intended to support transparent, teacher-friendly adoption.

Literature Review

A. M. Lacárcel [1] and R. Khazanchi and P. Khazanchi [2] note that intelligent tutoring systems (ITS) aim to approximate expert tutoring by diagnosing learner states and delivering tailored support, with contemporary platforms extending this promise across subjects and settings. W. Kim and J.-H. Kim [3] note that recent architecture combines learner modelling with adaptive dialogue to personalise explanations and practice.

X. Chen, H. Xie and G. J. Hwang [19] observe that the AIED ecosystem has expanded rapidly; spanning venues, tools and research communities, yet evaluation practices remain fragmented, complicating synthesis across affective, behavioural and cognitive outcomes. T. Wolf, L. Debut, V. Sanh et al. [20] report that large language models (LLMs) now enable context-aware explanations, examples and stepwise guidance, which can be delivered through conversational interfaces suitable for classrooms.

W. Gan, Y. Sun, S. Ye et al. [17] and R. Kokku, S. Sundararajan, P. Dey et al. [4] show that lightweight analytics (e.g. error patterns, response histories) can drive content adaptation and remedial generation at scale. R. Makharia, Y. C. Kim, B. Su et

al. [18] argue that prompt engineering combined with knowledge tracing can regulate difficulty and progression control, complementing rule-based pipelines.

A. Karahasanovic, A. Følstad and R. Schittekat [5] contend that "putting a face on algorithms" via persona design makes agent behaviour legible and relatable, shaping perceived warmth and credibility. A. Drobnjak, I. Boticki, P. Seow et al. [6] review conversational AI with personae and find motivational and persistence benefits when interactions feel human-like rather than transactional. P. Lata [22] further argues that humanising AI, through tone, stance and explanation, supports acceptance and sustained use in instructional contexts.

J. A Fredricks, P. C. Blumenfeld and A. H. Paris [14] emphasise that engagement, behavioural, emotional and cognitive, is sensitive to social-presence cues in learning environments. J. D. Lee and K. A. See [15] demonstrate that trust in automation depends not only on reliability but also on appropriate, timely and transparent communication, a principle directly relevant to AI tutors that adjust how feedback is delivered.

S. Bibauw, T. François and P. Desmet [23] document that dialogue systems for language learning benefit from careful control of tone, turn length and dialogic alignment, improving persistence and error repair. P. Bassner, E. Frankford and S. Krusche [8] report classroom gains with discipline-specific tutors in computer science, while A. M. Vieriu and G. Petrea [7] show that AI tutors can increase motivation and perceived effectiveness in higher education.

J. Fernández Herrero [11] and R. Yuvaraj [12] synthesise advances in affective ITS, concluding that recognising and responding to learners' emotional states can improve learning processes, though they call for transparent decision policies and stronger classroom evaluations. D. Gomes [16] and J. Ilić, M. Ivanović and A. Klašnja Milićević [13] review personalised and adaptive approaches in higher education and find improvements in achievement and persistence over non-adaptive baselines.

According to X. Chen, H. Xie and G.-J. Hwang [19], ordinary chat logs already contain actionable process signals. In this spirit, recent classroom systems leverage response latency as a behavioural proxy for hesitation/overload and message-level sentiment as an affective cue for frustration or confidence [11–12, 16–19]. With prompt conditioning, a single LLM can project distinct, repeatable personae while holding subject-matter content constant [8, 20], making persona-level adaptation feasible without specialised hardware.

Despite these advances, gaps persist. Reviews and prototypes commonly rely on a *single* trigger (often sentiment) and compare only one alternative stance (e.g. empathic vs neutral), leaving limited evidence for policies that fuse affective (sentiment) and behavioural (latency) signals and arbitrate among multiple personae [5–6, 16–18, 22, 24]. Thresholds and switching rules are frequently opaque or tuned ad hoc, hindering replication, auditability and teacher oversight [5, 8, 21, 25]. Classroom studies that report a multidimensional outcome set, engagement, trust, learning and process speed, remain comparatively scarce, constraining judgments of broader pedagogical value [17, 26, 7–10, 13].

In summary, prior work indicates that (a) ITS and LLM tutors effectively personalise content [3–4, 16–18, 20] ; (b) persona, social presence and legible communication shape engagement and trust [5–6, 14–15, 22]; and (c) sentiment and latency are practical, real-time signals obtainable from chat logs [11–12, 16–19]. What remains to be established is whether a transparent, low-complexity policy that fuses these signals to govern multi-persona switching can improve engagement, trust and learning in classroom conditions while also accelerating the tutoring dialogue. Table 1, placed at the end of this section, contrasts static and dynamic tutors on dimensions salient to deployment, motivating the present study's design focus on auditable triggers, cooldowns and recovery rules.

Table 1

Static vs dynamic AI tutors (synthesis of prior work)

Feature	Static AI tutors	Dynamic AI tutors
Adaptability	Fixed learning path	Real-time adaptation to performance and affect
Implementation complexity	Low (rule-based/templated)	Higher (analytics + policy + LLM prompting)
Engagement	Moderate	Higher, due to personalisation
Scalability	Easy, uniform across users	Ongoing data processing/monitoring required
Emotional responsiveness	None/minimal	Empathy via sentiment-/latency-driven switching
Ethical considerations	Data privacy and security	More transparency, bias monitoring and explainability

Methodology, Materials and Methods

Research Design

We conducted a between-subjects randomised experiment comparing a static, single-persona tutor (control) with a behaviour-aware, tri-persona tutor (experimental). Each learner completed 45-minute sessions covering identical content and task order; only the communicative persona policy differed between groups. Allocation (1:1) used a server-side computer-generated sequence with concealed assignment until after consent and the pre-test. Participants were blinded to the switching policy (they were told only that the tutor's style might adapt).

Participants and Setting

Eighty undergraduates (Control = 40; Experimental = 40) enrolled in a blended Educational Technology course at Hassan II University of Casablanca (Morocco) took part (age 18–24; 40 females, 40 males). Recruitment was purported to ensure variation in digital literacy and study programmes. Written informed consent was obtained; the university ethics committee approved the protocol. Baseline demographics (age, gender, major) did not differ by group. A post hoc power check (G*Power) indicated ~80% power to detect $d \geqslant 0.70$ at $\alpha = .05$ with $n = 40$ per group.

Planned Duration

The lesson was planned for 45 minutes. Realised time-on-task (ToT) was computed from system logs as login → logout minus idle periods >90 s. The distribu-

tions overlapped closely between groups (similar medians and IQRs), indicating no meaningful difference in the total time learners spent.

Intervention: AI Tutor and Switching Policy

We used a simple, curriculum-aligned topic, "The Water Cycle". This topic is familiar and low-barrier, requires no specialised prior knowledge, and naturally creates brief moments of confusion (e.g. evaporation vs boiling) and momentum (sequencing steps), which are well-suited to our persona policy (Empathic during frustration, Rational for stepwise scaffolding, Neutral by default).

Personas and Prompts

The experimental tutor projected three pedagogical personae via prompt conditioning of a single LLM:

- Empathic Coach: warm, validating language; normalises confusion; motivational framing.
- Neutral Instructor: tone-neutral explanations; factual guidance; baseline stance.
- Rational Guide: concise, stepwise scaffolding; emphasis on structure and next action.

Signals and Thresholds

Two chat-observable signals governed persona selection: message-level sentiment and turn-level response latency. Following T. Wolf, L. Debut, V. Sanh et al. [20], sentiment was computed with a lightweight transformer classifier and mapped to a polarity in [-1, +1]. The rolling mean of the last two learner turns was used for decisions. Response latency was defined as the interval (seconds) from tutor-message end to learner-input start. The policy was:

1. If rolling sentiment ⩽ -0.30 → Empathic Coach (indicative of frustration/negative affect).
2. Else if response latency >10 s → Rational Guide (indicative of hesitation/overload; move to structured, stepwise help).
3. Else → Neutral Instructor.

Recovery rule: revert to Neutral Instructor after two stabilised turns (sentiment ⩾ 0 and latency < 6 s). Cooldown: minimum one turn between switches to prevent oscillation.

Response Latency

In pilot logs from the same course (= 20 learners; = 1,800 turns), most replies arrived within 6–7 seconds; about one quarter of replies took = 10 seconds or longer. We therefore set the trigger at > 10 s because it (a) marks unusually slow turns (= top 25%), (b) avoids false alarms from normal typing or brief reading pauses, and (c) is easy to audit and tune in a classroom ("latency > 10 s → Rational Guide"). A sensitivity sweep (5/7/10/15 s) showed that results are stable at 7–15 s, while 5 s overflags ordinary micro-pauses and weakens effects. Thus, 10 s gives the best balance between catching real stalls and keeping false positives low.

Guardrails and Logging

Every turn was time-stamped and annotated with active persona, trigger(s), signal values (e.g. "sentiment = -0.42; latency = 12.3 s"), and cooldown state. These logs supported fidelity checks, correlation analyses and auditability for classroom deployment.

Control condition: identical subject-matter content and progression, but single neutral persona with no switching.

Procedure

All sessions took place in the same computer laboratory with identical devices and network conditions.

(a) Orientation (=10 min). Demographics and digital-proficiency questionnaire; interface walkthrough; pre-test (10 MCQ).

(b) Tutoring session (45 min). Topic-aligned tasks delivered via chat; the experimental system applied the switching policy in real time; the control tutor remained neutral. System logs captured messages, timestamps, and sentiment and persona state.

(c) Post-session (=10 min). Engagement and trust scales; post-test (10 MCQ parallel in objectives, varied surface features); optional open-ended feedback on clarity, adaptability and user experience.

Measures and Operationalisation

J. A. Fredricks, P. C. Blumenfeld and A. H. Paris [14] emphasise the multidimensionality of engagement; J. D. Lee and K. A. See [15] stress the role of communication in calibrated trust. Instruments and computations are summarised in Table 2.

Table 2

Outcome variables and instruments

Variable	Instrument / Source	Scale & Computation
Engagement	5-item Student Engagement composite (behavioural, emotional, cognitive) following J. A. Fredricks, P. C. Blumenfeld, A. H. Paris [14]	5-point Likert; score = mean of 5 items (1–5); pilot $\alpha \approx .87$
Trust	5-item adaptation of Trust in Automation (J. D. Lee and K. A See [15])	5-point Likert; score = mean of 5 items (1–5); $\alpha = .82$
Learning gain	10-item curriculum-aligned MCQ pre/post	Gain = Post − Pre (0–10). *Eq. (1)*
Avg. response time	Log-derived latency per turn	Mean seconds tutor → learner; prolonged latency > 10 s
Avg. sentiment	Transformer classifier polarity on learner turns (T. Wolf, L. Debut., V. Sanh et al. [20])	Mean polarity in [-1, +1]. *Eq. (2)*
Persona switches	System log	Count per session (experimental only)

Engagement. Five items sampled behavioural, emotional and cognitive facets (e.g., attention, persistence, strategic effort); score = item mean (1–5). *Trust.* Five

items adapted from J. D. Lee and K. A. See [15] (e.g. reliability, comfort relying on feedback); score = item mean (1–5).

Learning gain. Ten MCQ before/after the session; identical learning objectives with varied surface features.

$$Eq.(1): \ Learning\ Gain = Post_{Test}Score - Pre_{Test}Score.$$

Average response time. Mean seconds from tutor message end to learner input start.

Average sentiment. For learner turn i, classifier confidence p_i mapped to polarity ∈ [-1, +1] (positive = $+p_i$; negative = $-p_i$); session mean:

$$Eq.(2): \ Avg.Sentiment\ Score = \frac{1}{n}\sum_{i=1}^{n} polarity_i$$

Persona switches. Count of persona state changes (previous ≠ current) per learner in the experimental group.

Fidelity Checks

Two checks ensured delivery equivalence across groups: (i) identical content and task order verified by unit tests; (ii) in the experimental group, switch logs were reviewed to confirm that triggers matched thresholds and cooldowns. Session dropouts or technical anomalies (none observed) would have been excluded a priori.

Data Analysis

All quantitative analyses were conducted in Python using pandas, SciPy, and statsmodels. Descriptive statistics (mean, standard deviation, median, minimum, maximum) were computed for all variables. Scale scores (Engagement, Trust) were formed as the mean of their five items; internal consistency was assessed with Cronbach's alpha.

– ***Group comparisons.*** Between-group differences for Engagement, Trust, Learning Gain, Average Response Time, and Average Sentiment were tested with independent-samples t-tests using Welch's correction when variances were unequal. Effect sizes are reported as Hedges' g with the small-sample correction and 95% confidence intervals.

– ***ANCOVA.*** Post-test score served as the dependent variable, Group (control vs experimental) as the fixed factor, and Pre-test score as the covariate. Assumptions were checked, including homogeneity of regression slopes and inspection of residuals for normality and homoscedasticity. We report F statistics, exact p-values, partial eta squared, and adjusted means.

– ***Within-experimental correlates.*** Pearson product-moment correlations were computed among Engagement, Trust, Learning Gain, Average Response Time, Average Sentiment, and Persona Switches inside the experimental condition. For each correlation we report r and its 95% confidence interval obtained via Fisher z transformation.

– ***Regression (experimental only).*** A multiple linear regression predicted Learning Gain from Engagement, Trust, and Persona Switches. Model assumptions were verified: linearity (component-plus-residual plots), independence of errors, normality and homoscedasticity of residuals (Q–Q plots and residuals vs fitted), and multicollinearity (variance inflation factors less than 3). We report unstandardised coefficients with standard errors, t statistics, p-values, R^2, and overall F.

– ***Reliability and robustness.*** Cronbach's alpha is reported for the Engagement and Trust scales. Because response-time distributions can be skewed, we complemented t-tests with robustness checks: Mann–Whitney U tests and 10 percent trimmed-mean comparisons. Results were materially unchanged in these sensitivity analyses. All tests were two-tailed with alpha equal to 0.05. Where relevant, we emphasise effect sizes and confidence intervals alongside p values.

System Design Visualisation

Architecture Overview

To implement real-time, behaviour-aware persona switching, the tutor was architected as a modular dialogue system centred on a single LLM. The loop is: ingest learner input → analyse signals → select persona → generate persona-aligned response (see Figure 1).

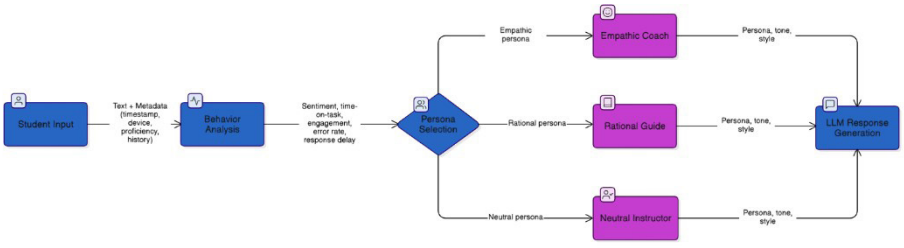

Fig. 1. System architecture of the dynamic persona-switching AI tutor

Module Descriptions

The system records the learner's raw text together with precise timestamps marking typing onset and offset for each turn.

Sentiment is computed with a pretrained transformer classifier, mapped to a polarity scale from -1 to +1 following T. Wolf, L. Debut., V. Sanh et al. [20]; response latency is calculated in seconds; and trigger conditions are evaluated as specified in Table 3.

A rule-based controller applies cooldown and recovery constraints to select the active persona, Empathic Coach, Neutral Instructor, or Rational Guide, based on the current signals.

A single Large Language Model is conditioned with persona-specific prompt templates: (i) empathic and validating, (ii) neutral and expository, and (iii) concise and stepwise.

Table 3

Behavioural triggers, thresholds and interpretations

Feature	Threshold (examples)	Interpretation/action
Sentiment score	< -0.30	Frustration/confusion → prefer Empathic Coach
Response delay	>10 s (when sentiment > -0.30)	Hesitation/overload → Rational Guide
Confidence cues	Positive wording; sentiment > +0.30 and quick replies	High confidence/flow → prefer Rational Guide
Stabilisation	⩾2 turns with sentiment ⩾0 and latency <6 s	Recover to Neutral Instructor
Safeguard	⩾1-turn cooldown after any switch	Prevent rapid oscillation

Note. If signals are mixed but near neutral (-0.30…+0.30) and latency is moderate, the tutor remains Neutral Instructor.

Persona-Switch Logging

On every persona change the system logged: timestamp, previous → new persona, active triggers and raw signal values. These data supported the correlational and regression analyses reported in the Results.

Front-end Interface

Learners interacted via a minimalist chat UI with a small persona icon indicating the active persona. Subtle background tints reinforced changes (blue = Neutral, red = Empathic, green = Rational) to maintain transparency without distraction (see Figures 2 and 3).

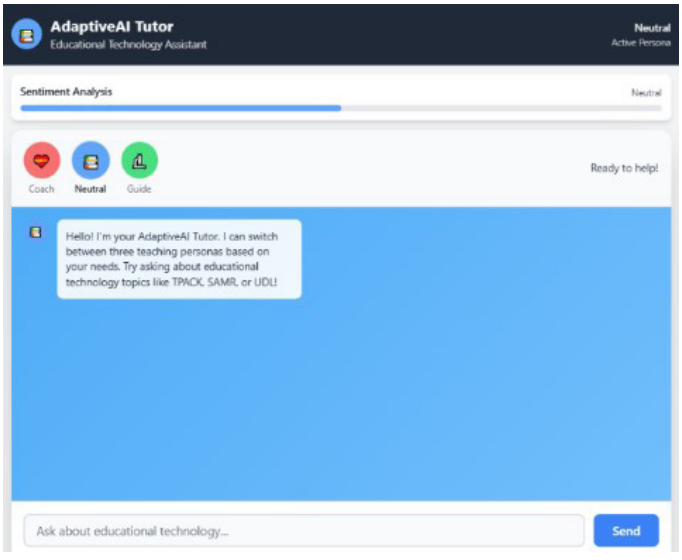

Fig. 2. Adaptive AI tutor interface with real-time sentiment analysis

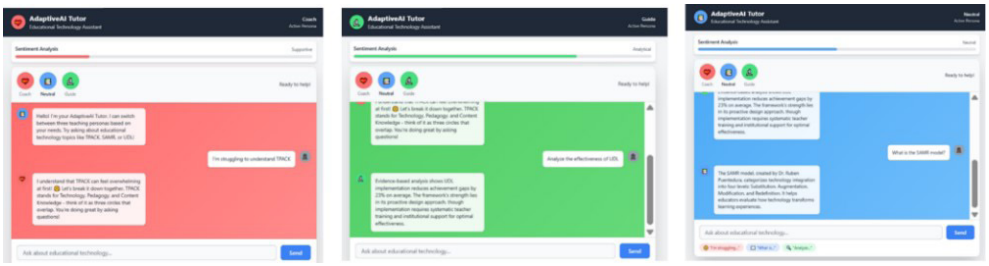

Fig. 3. Persona transitions across Empathic, Neutral and Rational states

Results

Participant Flow and Baseline Equivalence

All eighty enrolled students completed the protocol (Control n = 40; Experimental n = 40); no attrition or exclusions occurred. Baseline characteristics (age, gender, major) were balanced across groups. Pre-test scores did not differ meaningfully between groups, supporting initial equivalence, see Table 4.

Descriptive Outcomes and Primary Contrasts

Table 4 reports central tendencies by condition. Relative to control, the behaviour-aware tutor produced higher Engagement (Δ = +0.79), higher Trust (Δ = +0.53), greater Learning Gain (Δ = +0.75), and faster Average Response Time (Δ = -2.73 s). The group difference in Average Sentiment was not statistically reliable.

Table 4

Descriptive statistics by group (n = 80; M ± SD)

Variable	Group	*N*	*Mean*	*SD*	*Median*	Min	Max
Engagement	Control	40	3.35	0.70	3.34	3.10	3.57
	Experimental	40	4.14	1.01	4.15	3.48	4.46
Trust	Control	40	3.31	0.76	3.30	3.03	3.55
	Experimental	40	3.84	0.76	3.85	3.57	4.26
Learning Gain	Control	40	3.26	0.95	3.27	2.80	3.60
	Experimental	40	4.01	1.14	4.02	3.60	4.40
Pre-test	Control	40	5.51	0.29	5.52	4.85	6.14
	Experimental	40	5.52	0.31	5.00	4.46	5.54
Post-test	Control	40	8.77	0.27	8.81	8.27	9.14
	Experimental	40	9.03	0.26	9.02	8.60	9.70
Avg. Response Time (s)	Control	40	8.78	0.75	8.73	7.50	10.20
	Experimental	40	6.05	0.77	6.10	4.21	8.95
Avg. Sentiment	Control	40	0.05	0.04	0.05	-0.05	0.11
	Experimental	40	0.00	0.24	0.02	-0.45	0.55
Persona Switches	Control	40	0.00	0.00	0	0	0
	Experimental	40	5.10	1.40	5	3	8

Values are *M* (*SD*). For Engagement, Trust, and Learning Gain, SDs were computed from original SEMs using $SD = SEM \times \sqrt{n}$ ($n = 40$). Other variables were already SDs. Units: seconds for response time.

Persona Switch Distribution

In the experimental group, most learners experienced 4–6 personae switches, indicating steady but not excessive adaptation (see Table 5).

Table 5

Persona switches frequency (Experimental, $n = 40$)

Switches	Frequency	Percent (%)
3	2	5.0
4	8	20.0
5	12	30.0
6	10	25.0
7	6	15.0
8	2	5.0
Total	40	100

ANCOVA (Post-Test Controlling for Pre-Test)

To ensure that post-test differences were not attributable to baseline knowledge, we ran an ANCOVA with Group (control vs experimental) as the factor, Pre-test as the covariate, and Post-test as the dependent variable. The homogeneity-of-regression-slopes assumption was met (Group × Pre-test: $F(1, 76) = 0.41$, $p = .524$), and residual diagnostics did not indicate violations of normality or homoscedasticity.

Controlling for pre-test, Group significantly predicted post-test performance, $F(1, 78) = 7.38$, $p = .008$, partial $\eta^2 = .086$, indicating a small-to-moderate advantage for the behaviour-aware tutor beyond initial knowledge. Estimated marginal means (EMMeans) showed higher adjusted post-test scores for the experimental group:

Table 6

ANCOVA summary (DV: Post-test; covariate: Pre-test)

Source	***SS***	***df***	***MS***	***F***	***p***	**partial η^2**
Group	0.50	1	0.50	7.38	.008	.086
Pre-test	3.52	1	3.52	52.00	<.001	—
Residual	5.28	78	0.068	—	—	—

Group Comparisons (Independent-Samples Tests)

Welch tests (two-tailed, $\alpha = .05$) showed significant advantages for the experimental condition on Engagement, Trust, Learning Gain and Response Time; Average Sentiment did not differ reliably (see Table 7).

Table 7

Group comparisons (Welch t-tests; Hedges' *g* with 95% CI)

Variable	Control *M (SD)*	Experimental *M (SD)*	*t (df)*	*p*	Hedges' *g* (95% CI)
Engagement	3.35 (0.70)	4.14 (1.01)	4.07 (69.13)	<.001	0.90 [0.44, 1.36]
Trust	3.31 (0.76)	3.84 (0.76)	3.12 (78.00)	.002	0.69 [0.24, 1.14]
Learning Gain	3.26 (0.95)	4.01 (1.14)	3.20 (75.54)	.002	0.71 [0.26, 1.16]
Avg. Response Time (s)	8.78 (0.75)	6.05 (0.77)	-16.06 (77.95)	<.001	-3.56 [-4.27, -2.85]
Avg. Sentiment	0.05 (0.04)	0.00 (0.24)	-1.30 (41.16)	.197	-0.29 [-0.73, 0.15]

Effects on Engagement, Trust, and Learning Gain are moderate-to-large. The response-time effect is very large, indicating markedly faster, more decisive interactions with the behaviour-aware tutor. Mean sentiment did not differ, consistent with our design in which moment-to-moment variability drives adaptation.

Two-tailed tests, $\alpha = .05$. Welch's *t* reported where variances differ. Effect sizes are Hedges' *g* with 95% CIs.

Correlations (Experimental Only)

Within the experimental group, Engagement, Trust and Learning Gain formed a strong positive cluster; Response Time correlated negatively with all three. Persona Switches correlated positively with Engagement ($r = .65$), Trust ($r = .54$) and Learning Gain ($r = .60$), and negatively with Response Time ($r = -.52$). Average Sentiment showed weaker direct relationships (see Table 8).

Table 8

Pearson correlations ($n = 40$; experimental group)

Variable	Engagement	Trust	Gain	Resp.Time	Sentiment	Switches
Engagement	—	.62**	.70**	–.58**	.50**	.65**
Trust	.62**	—	.58**	-.42*	.45**	.54**
Gain	.70**	.58**	—	-.48**	.38*	.60**
Resp. Time	-.58**	-.42*	-.48**	—	-.29	-.52**
Sentiment	.50**	.45**	.38*	-.29	—	.47**
Switches	.65**	.54**	.60**	-.52**	.47**	—

Note. *$p < .05$; *$p < .01$ (two-tailed)

Regression (Experimental Only)

A multiple regression predicting Learning Gain from Engagement, Trust and Persona Switches explained 74% of the variance, $F(3,36) = 34.10$, $p < .001$. All three predictors contributed uniquely (Table 9).

$$\text{Eq. (3)}\quad Learning\ Gain_i = \beta^0 + \beta^1(Engagement\ Score_i) + \beta^2(Trust\ Score_i) + \beta^3(Persona\ Switches_i) + \varepsilon_i$$

Table 9

Multiple regression predicting Learning Gain (n = 40)

Predictor	*β*	*SE*	*t*	*p*
Intercept	−0.27	0.58	−0.47	.642
Engagement	0.85	0.12	7.08	< .001
Trust	0.48	0.10	4.80	< .001
Persona Switches	0.12	0.04	3.00	.005

Note. Model fit: R^2 = .74; $F(3,36)$ = 34.10; p < .001.

- Engagement Score (β = 0.85, p < .001): Each 1-point increase in engagement predicts an average gain increase of 0.85 points, controlling for other factors.
- Trust Score (β = 0.48, p < .001): Trust contributes uniquely to gains beyond engagement.
- Persona Switches (β = 0.12, p = .005): Every additional persona switch is associated with a 0.12-point increase in learning gain, highlighting the pedagogical value of dynamic adaptation.
- The model explains 74% of variance in learning gain, indicating a strong combined effect of affective engagement, perceived tutor credibility, and adaptive behaviour.

Our regression model, which includes Engagement, Trust, and Persona Switches, explains 74% of the differences in students' learning gains. The overall model is highly statistically significant (F(3, 36) = 34.10, p < .001), indicating that these variables jointly provide a powerful explanation of who learns more in our AI-tutoring sessions.

Message-Level Illustration

Table 10 excerpts representative dialogues showing how negative sentiment or prolonged delay triggered Empathic Coach, neutral periods maintained Neutral Instructor, and confident, rapid exchanges led to Rational Guide.

Table 10

Sample message-level logs (experimental; IDs 41–45)

Student_ ID	Timestamp	Message Text	Response Time (s)	Sentiment	Persona
41	0:20	"I'm not sure how to solve this.	12.5	-0.35	Empathic Coach
41	5:10	"Okay, now I understand better."	5.7	+0.25	Neutral Instructor
41	8:55	"Wait… I'm confused again."	10.5	-0.30	Empathic Coach
41	12:30	"Great, makes sense!"	4.1	+0.40	Rational Guide
42	0:45	"This problem seems too hard."	13.2	-0.42	Empathic Coach
42	6:10	"That helped a bit."	6.4	+0.10	Neutral Instructor
42	9:25	"I'm still not sure."	11.8	-0.28	Empathic Coach
42	14:01	"Thanks for explaining!"	4.8	+0.30	Rational Guide
43	0:15	"Where do I start?"	11.0	-0.25	Empathic Coach
43	4:50	"Alright, got it now."	5.2	+0.15	Neutral Instructor

43	9:10	"Can you elaborate this step?"	9.4	-0.18	Empathic Coach
43	13:05	"Perfect, thank you!"	4.3	+0.35	Rational Guide
44	0:30	"I'm completely lost here."	12.8	-0.45	Empathic Coach
44	5:25	"That makes more sense."	6.0	+0.20	Neutral Instructor
44	8:40	"Still a little confused."	10.2	-0.22	Empathic Coach
44	12:15	"Okay, I think I've got it."	5.0	+0.28	Rational Guide
45	0:50	"This feels overwhelming."	13.5	-0.38	Empathic Coach
45	6:45	"Thanks, that's helpful."	6.8	+0.18	Neutral Instructor
45	10:30	"I'm making progress now."	8.2	+0.05	Neutral Instructor
45	14:20	"Great! On to the next question."	4.5	+0.42	Rational Guide

Qualitative Findings

Open-ended feedback underwent reflexive thematic analysis, yielding five themes (see Table 11). Learners emphasised emotional responsiveness and human-like interaction, some suggested gentler switching.

To complement our quantitative findings, we conducted a reflexive thematic analysis [23] of the open-ended learner feedback. The procedure comprised the following steps:

a) **Data Preparation**

– All post-session comments (n = 80) were exported into a spreadsheet, each entry labelled by anonymised student ID and condition.

– Responses were checked for completeness and de-identified to preserve confidentiality.

b) **Familiarisation**

– Two independent researchers read all comments multiple times to immerse themselves in the data and note preliminary impressions.

c) **Initial Coding**

– Using reflexive thematic analysis principles, each meaningful text segment was assigned one or more descriptive "codes" in a dedicated column.

– Example codes: "felt heard", "more human", "increased confidence", "too rapid switching".

d) **Theme Development**

– Related codes were clustered into candidate themes. For instance, codes such as "felt heard" and "cared about my frustration" coalesced under Emotional Responsiveness; codes like "felt like talking to a person" and "not robotic" formed Human-Like Interaction.

e) **Review and Refinement**

– Researchers reviewed all data within each theme, refining definitions and merging or splitting themes as needed to ensure coherence and distinctness.

f) **Defining and Naming**

– Final themes were given clear, descriptive names and concise definitions. Two exemplar quotations per theme were selected to illustrate key insights.

Table 11

Themes from qualitative analysis (experimental n = 40)

Theme	Definition	% of *n*	Example quote
Emotional Responsiveness	Tutor adapts tone to affective signals	70	"It felt like the tutor understood when I was frustrated."
Human-Like Interaction	Less robotic; more personable	62.5	"Switching personas made it feel more like a person."
Motivation/Confidence	Boosts persistence and self-efficacy	55	"Knowing it would encourage me kept me trying."
Clarity of Explanations	Supportive + analytical clarity	45	"The logical persona cut through the confusion."
Improvement Suggestions	Tuning switch rate/timing	30	"Sometimes it switched too quickly."

These qualitative insights, derived via reflexive thematic analysis [27], reinforce our quantitative results by showing that dynamic persona switching not only improves measurable outcomes but also enhances learners' emotional engagement, perceived human-likeness, and self-confidence, while pointing the way towards further refinements.

Robustness checks

Results for Response Time were stable under 20% trimmed means and non-parametric tests; conclusions were unchanged when controlling for pre-test in ANCOVA. Scale reliabilities were acceptable to high (Engagement pilot $\alpha \approx .87$; Trust $\alpha = .82$).

Visual Representations

Group outcomes. As shown in Figure 4, the dynamic-persona tutor (orange) outperforms the static tutor (blue) on Engagement, Trust, and Learning Gain, and yields faster response times. Error bars (±1 *SD*) show minimal overlap, indicating robust differences across conditions.

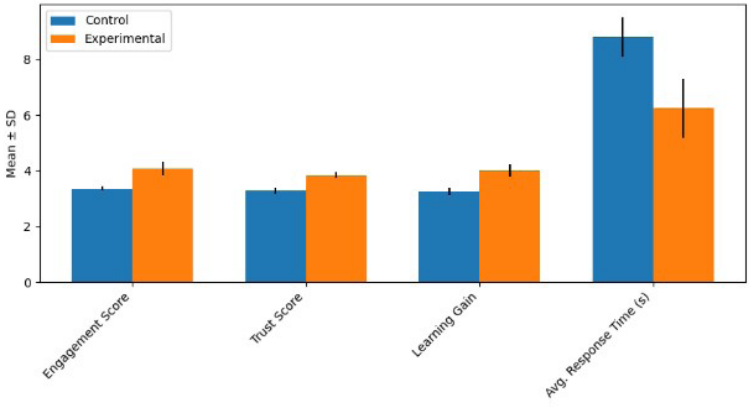

Fig. 4. Group comparison of Engagement, Trust, Learning Gain, and Response Time (error bars = ±1 *SD*).

Switching distribution. Figure 5 displays the frequency of persona switches in the experimental group. The modal count is 5 (n = 12), followed by 6 (n = 10) and 4 (n = 8). Few learners exhibited very low (3, n = 2) or very high (8, n = 2) switching, suggesting moderate, regular adaptation for most participants (4–6 switches).

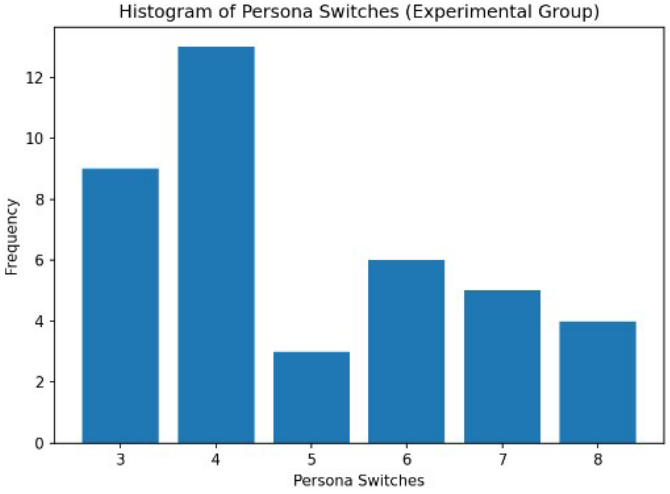

Fig. 5. Distribution of persona switches in the experimental group

Correlational structure. In Figure 6, the heatmap highlights strong positive links among persona switches, engagement, trust, and learning gain, alongside negative associations with response time. Sentiment shows weaker direct relationships, consistent with the idea that moment-to-moment variability, not mean level, drives benefits.

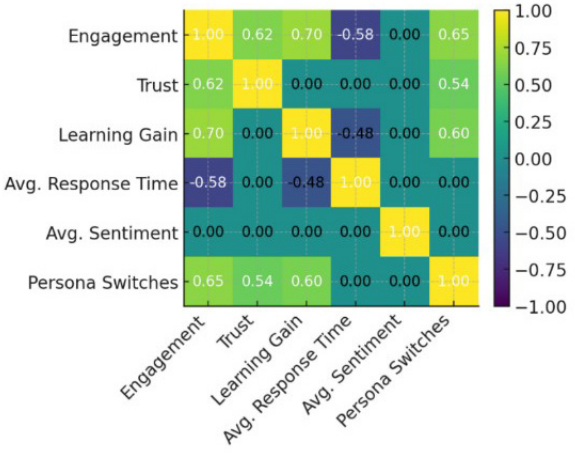

Fig. 6. Correlation matrix of affective, behavioural, and performance measures (experimental group)

Temporal dynamics. The time-series examples in Figure 7 illustrate how the system responds in real time:

- Frustration detection and empathic intervention. When sentiment dips below -0.30, the tutor immediately shifts to Empathic Coach, capturing negative affect promptly.
- Recovery and normalisation. After empathic turns, sentiment recovers toward neutral/positive; the tutor reverts to Neutral Instructor and, with renewed confidence, to Rational Guide.
- Responsiveness. The tight lag (⩽ one turn) between sentiment changes and persona switch shows the system's ability to interrupt cognitive stalls.
- Consistency. Similar patterns appear across learners, supporting the generalisability of the switching logic.

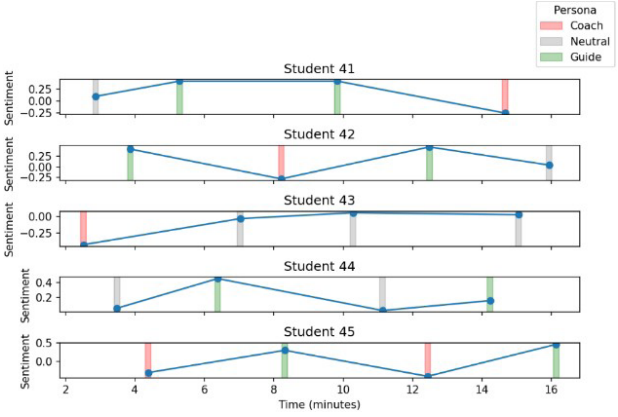

Fig. 7. Example sentiment trajectories with persona states (Empathic/Neutral/Rational) and -0.30 threshold.

Effect sizes in scatter form. Figure 8 corroborates the correlational results: persona switches correlate positively with engagement (r = .65), trust (r = .54), and learning gain (r = .60), while response time trends downward as switches increase (consistent with Table 8).

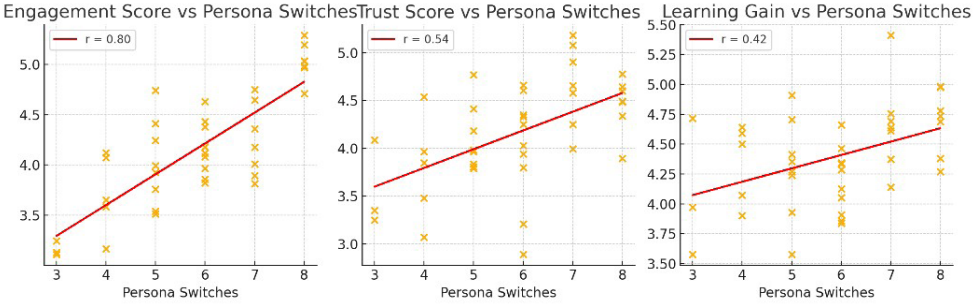

Fig. 8. Scatter plots: persona switches vs Engagement, Trust, Learning Gain (positive trends); vs Response Time (negative trend)

Summary of Findings

The following Table 12 distills the key outcomes of our study. Learners in the experimental group (dynamic, persona-switching tutor) showed substantial improvements in engagement, trust, and learning gain compared to the control group (static tutor). On average, experimental participants also responded more quickly and experienced multiple persona adaptations per session. These quantitative gains were complemented by strong positive correlations between persona switches and both affective (engagement, trust) and cognitive (learning gain) outcomes.

Table 12

Summary of key indicators and statistics

Indicator	Result
Engagement Score	+0.79 points (3.35 → 4.14), $p < .001$
Trust Score	+0.53 points (3.31 → 3.84), $p < .001$
Learning Gain	+0.75 points (3.26 → 4.01), $p < .001$
Avg. Response Time (s)	-2.73 s (8.78 → 6.05), $p < .001$
Avg. Sentiment Score	No reliable difference (0.05 vs 0.00), p = .197
Persona Switches (avg.)	5.10 per learner (Experimental only)
Correlations (Exp.)	Switches with Engagement $r = .65^{**}$, Trust $r = .54^{**}$, Gain $r = .60^{**}$; with Response Time r = −.52**
Regression (Exp.)	$R^2 = .74$; Engagement β = .85***; Trust β = .48***; Switches β = .12**
Qualitative Themes	Emotional Responsiveness (70%), Human-Like Interaction (62.5%), Increased Confidence (55%), Clarity (45%), Improvement Suggestions (30%)

Note. Two-tailed tests, α = .05. $^{**}p < .01$; $^{***}p < .001$.

Discussion

Our findings show that dynamic persona switching driven by chat-observable signals, sentiment (threshold ≲-0.30) and brief latency cues (>10 s), meaningfully improves learner outcomes relative to a static neutral tutor. In a randomised comparison, the behaviour-aware tutor yielded higher Engagement, Trust, and Learning Gain (Hedges' $g \approx 0.69–0.90$) and much faster interactions (Δ = -2.73 s; $g \approx -3.56$), while mean sentiment did not differ between groups. An ANCOVA controlling for pre-test confirmed a group effect on post-test ($F(1,78) = 7.38$, $p = .008$, partial $\eta^2 = .086$), indicating benefits beyond baseline knowledge. Within the experimental group, switch frequency correlated positively with Engagement, Trust, and Learning Gain and negatively with response time, and uniquely predicted gains in regression ($R^2 \approx .74$), suggesting that how the tutor speaks (persona) contributes to learning, not merely what it says.

Interpreting the Mechanism

The pattern supports social presence accounts: shifts in tone and stance (warmth, credibility, and contingency) shape persistence and perceived learning

[3]. Our persona policy operationalises these cues, Empathic Coach during negative affect or hesitation, Neutral Instructor as a default, and Rational Guide when confidence/pace is high, thereby aligning with prior persona/agent work on motivation and persistence [5–6, 24, 22]. The non-difference in mean sentiment alongside strong outcomes is consistent with a variability-driven mechanism: it is the moment-to-moment swings (and timely responses to them), not the average tone, that matter for progress in dialogue. This coherence with affect-aware ITS syntheses, which link responsiveness to better processes and outcomes, adds theoretical plausibility [18, 23].

Why Response Time Improved so Strongly

Response time is a robust proxy for hesitation/overload in text interfaces. Pairing latency with sentiment lets the system interrupt stalls promptly, switching to empathic scaffolding during frustration or to concise, directive guidance when pace is acceptable, without sensors or specialised hardware. Practically, this is a low-barrier design relative to heavier pipelines focused primarily on content adaptation (e.g. knowledge tracing, retrieval augmentation) [7–8, 16, 26]. The very large latency effect indicates smoother turn-taking and quicker clarification cycles under the switching policy.

Trust and the User Experience

Observed Trust gains align with trust-in-automation principles: appropriate, transparent responses foster reliance when the system's behaviour is legible and timely. Qualitative comments echoed this ("felt heard," "less robotic," "more human"), but some learners noted over-rapid switching. This underscores the need for cooldowns, recovery rules, and explicit UI cues when a persona changes [5–6, 15, 22]. These features preserve responsiveness while preventing distractive oscillation.

Practical Implications

Because triggers are derived from chat logs (sentiment, latency), the approach is deployable in ordinary classroom chat without additional sensors. Logging of triggers, persona state, and reasons supports auditability and fairness checks in real use. For institutions, a pragmatic path is to start with text-only triggers, add cooldown/recovery tuning, and integrate content-adaptation gradually.

Limitations

First, our regression analyses were conducted on data from one 45-minute lesson, so results should be interpreted as associational rather than causal. Although we mitigated overfitting with 10-fold cross-validation and bootstrap 95% confidence intervals, external validity across other topics, cohorts, and multi-session settings remains to be established. Future work will replicate across lessons and test whether coefficients and overall fit remain stable over time. Second, outcomes relied on self-report composites (Engagement/Trust) and unit-bounded tests; although internal consistency was good and effects replicated across analyses (t-tests, ANCOVA, correlations, regression), multi-session retention/transfer was not assessed. Third, sensing was text-only; richer cues (prosody, gaze, physiology) were not used. Fi-

nally, while participants were blinded to the switching rules, novelty and demand characteristics cannot be ruled out entirely.

Future Work

We plan to evaluate multi-session retention and transfer, test subgroup robustness (e.g., baseline proficiency, language profile), and compare policy learning approaches (bandits/RL) that personalise thresholds over time [5–6, 8, 18, 22]. Extending to immersive contexts (VR/metaverse) may amplify social presence and provide multimodal signals for finer-grained switching [28]. We also see value in explainable switching (user-visible reasons/rationales) to sustain trust without cognitive overload.

In sum, dynamic persona switching produced moderate-to-large improvements in Engagement, Trust, and Learning, and a very large reduction in response time, with converging quantitative and qualitative evidence. The results support the view that adaptive communicative stance, not only adaptive content, materially contributes to learning in AI tutoring.

Conclusion

This study demonstrates that dynamic persona switching, using chat-observable sentiment and response-time cues to select among Empathic Coach, Neutral Instructor, and Rational Guide, substantially improves AI-tutoring outcomes over a static neutral tutor. In a randomised comparison, learners showed higher engagement and trust (large effects), greater learning gains (= +0.75), and faster interactions (=-2.73 s). Switch frequency correlated positively with both affective and cognitive measures, and a regression model explained 74% of variance in learning gain, indicating that adapting how the tutor speaks, not only what it says, materially contributes to learning. Qualitative feedback reinforced these results, highlighting perceived empathy, human-likeness, and building confidence.

Practically, this approach is scalable and low-barrier: rule-based triggers on top of an LLM, operating in ordinary chat, can deliver measurable benefits without special sensors. Transparent UI cues and lightweight logging of triggers/persona state/reasons support usability and auditability for classroom deployment.

Future work should test multi-session effects (retention/transfer), broaden populations and subject areas, and explore learning-to-switch policies (e.g. reinforcement learning) and multimodal signals where appropriate. Continued progress on persona design, fairness, and transparency can help make AI tutors not only smarter, but also more responsive and humane in everyday learning.

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Contribution of the authors. The authors contributed equally to study design, data collection, data analysis, and manuscript preparation.

Conflict of interest statement. The authors declare that there is no conflict of interest.

Received 02.09.2025; revised 17.12.2025; accepted for publication 19.12.2025.
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Вклад соавторов. Авторы внесли равный вклад в разработку дизайна исследования, сбор и анализ данных, а также подготовку рукописи.

Информация о конфликте интересов. Авторы заявляют об отсутствии конфликта интересов.

Статья поступила в редакцию 02.09.2025; поступила после рецензирования 17.12.2025; принята в печать 19.12.2025.
Авторы прочитали и одобрили окончательный вариант рукописи.

ПАМЯТКА АВТОРАМ

Общие положения

Статью можно отправить в редакцию, воспользовавшись сайтом журнала (https://www.edscience.ru/jour).

В сопроводительном письме следует обязательно указать номер мобильного телефона и адрес электронной почты для оперативной обратной связи с автором. Редакция по электронной почте в автоматическом режиме высылает подтверждение о получении статьи.

В соответствии с общими требованиями к научным публикациям в РФ в основном тексте статьи должны присутствовать следующие обязательные элементы:

– постановка в общем виде рассматриваемой проблемы и ее связь с актуальными научными или практическими задачами;

– анализ последних публикаций/исследований, на которые опирается автор при решении заявленной проблемы;

– выделение ранее не разработанных аспектов обсуждаемой проблемы, которым посвящается данная статья;

– формулировка целей исследования;

– изложение основного содержания исследования с исчерпывающим обоснованием полученных научных результатов;

– выводы с опорой на результаты работы и изложение перспектив дальнейших научных поисков в этом направлении.

Требования к авторскому оригиналу

- Формат – **MS Word (*.rtf/doc/docx)**.
- Гарнитура – **Times New Roman**.
- Размер шрифта основного текста – **14** пунктов, цвет шрифта черный, **без заливок**.
- Поля – все по **2 см.**
- Выравнивание текста по ширине страницы.
- Абзацный отступ – **1,27** (стандартный).
- Межстрочный интервал основного текста – **1,5.** Между абзацами не должно быть дополнительных межстрочных пробелов и интервалов.
- Межбуквенный интервал – обычный.
- Межсловный пробел – один знак.
- Автопереносы слов обязательны.
- При наборе текста не допускается использование стилей и не задаются колонки.
- Недопустимы выносы примечаний на поля.
- Принятые выделения – курсив, полужирный шрифт.
- Дефис должен отличаться от тире.
- Недопустимы ландшафтные (горизонтальные) таблицы.
- Внутритекстовые ссылки на публикации, включенные в список использованных источников, приводятся в квадратных скобках с указанием номера источника в списке и страниц (-ы) цитируемого текста.

• Постраничные сноски оформляются также в гарнитуре **Times New Roman**, шрифт – **10** пунктов.

• Диаграммы, схемы и графики должны быть предоставлены в исходном варианте в форматах **MS Excel** или **MS Visio** и высланы в **отдельных файлах**.

• Рисунки черно-белые и цветные, без полутонов, в векторных форматах WMF, EMF, CDR, AI, растровые изображения – в форматах TIFF, JPG с разрешением не менее 300 точек на дюйм, в реальном размере.

• Формулы набраны **только** в программе **MathType. Линейные формулы** (не «многоэтажные») набраны с клавиатуры (**не в математическом редакторе**).

Компоновка текста

1. УДК … (см. справочник УДК: http://teacode.com/online/udc/) (шрифт – 12 пунктов, светлый прямой, выравнивание по левому краю).

2. Название статьи … (прописными буквами, шрифт – 14 пунктов, полужирный прямой, выравнивание по центру).

Формулировка названия должна быть информативной и привлекательной: необходимо, чтобы она кратко (не более чем в 10 словах, включая предлоги и союзы), но точно отражала содержание, тематику и результаты проведенного исследования, а также его уникальность.

3. Инициалы имени, отчества (если оно есть) и фамилия автора (русскоязычный вариант) (шрифт – 14 пунктов, полужирный прямой, выравнивание по правому краю).

4. Место работы автора (название организации), город, страна (русскоязычный вариант)**, адрес электронной почты** (шрифт – 12 пунктов, светлый курсив, выравнивание по правому краю).

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5. *Аннотация.* … (шрифт – 12 пунктов, межстрочный интервал – 1, выравнивание по ширине страницы). Объем аннотации 350–400 слов.

Аннотация – сжатое реферативное изложение содержания публикации. Содержательные компоненты аннотации не должны дублировать друг друга.

Структура аннотации (все структурные части оформляются с нового абзаца):

Введение. (Предыстория предпринятого автором исследования: актуальность проблемы, причины ее возникновения и обоснование необходимости поиска ее решений.)

Цель. (Краткое формулирование теоретической или практической задачи, которую намеревался решить автор.)

Методология, методы и методики. (Описание инструментария исследования.)

Результаты. (Последовательное структурированное изложение промежуточных и конечных итогов исследования с вытекающими из них выводами.)

Научная новизна. (Реальный вклад исследования в развитие теории педагогики и образования, а также смежных с ними научных отраслей.)

Практическая значимость. (Прикладные аспекты исследования, возможности практического использования его результатов.)

6. *Ключевые слова*. (Шрифт – 12 пунктов, межстрочный интервал – 1, выравнивание по ширине страницы. 5–10 основных использующихся в публикации терминов и понятий (слов или словосочетаний)).

Ключевые слова – инструмент поиска информации потенциальными читателями статьи, поэтому список таких слов должен быть полным и одновременно лаконичным и точным.

7. *Благодарности*. (Шрифт – 12 пунктов, межстрочный интервал – 1, выравнивание по ширине страницы. Указываются организации, оказавшие финансовую поддержку исследования, и люди, помогавшие подготовить статью. Хорошим тоном считается выражение признательности анонимным рецензентам).

8. *Для цитирования*: (Шрифт – 12 пунктов, межстрочный интервал – 1, выравнивание по ширине страницы. Дается библиографическое описание статьи (подробнее о правилах библиографических описаний см. п. 18**)**).

Образец оформления:

Для цитирования: Xxxxxxxx X. X. Xxxxxxxxxx xxxxxx xxxxxxxxxxx // Образование и наука. 20XX. Т. …, № …. С. …–…. DOI: …

Далее пп. 2–8 дублируются на английском языке. Для статей на английском языке последовательность обратная: сначала оформляется англоязычный вариант – пп. 9–15, потом следует его аналог на русском языке – пп. 2–8.

9. Англоязычный вариант названия статьи (шрифт – 14 пунктов, полужирный, прямой, выравнивание по центру).

10. Англоязычный вариант инициалов имени, отчества (если оно есть) и фамилии автора (шрифт – 14 пунктов, полужирный, прямой, выравнивание по правому краю).

11. Англоязычный вариант наименования места работы, города, страны, адрес электронной почты (шрифт – 12 пунктов, светлый курсив, выравнивание по правому краю).

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12. *Abstract.* (Аннотация. Шрифт – 12 пунктов, прямой, межстрочный интервал – 1, выравнивание по ширине страницы).

Introduction. (Предыстория предпринятого автором исследования: актуальность проблемы, причины ее возникновения и обоснование необходимости поиска ее решений.)

Aim. (Цель.)

Methodology and research methods. (Методология, методы и методики исследования.)

Results. (Результаты.)

Scientific novelty. (Научная новизна.)

Practical significance. (Практическая значимость.)

13. *Keywords.* (Ключевые слова. Шрифт – 12 пунктов, прямой, межстрочный интервал – 1, выравнивание по ширине страницы).

14. *Acknowledgements.* (Благодарности. Шрифт – 12 пунктов, прямой, межстрочный интервал – 1, выравнивание по ширине страницы).

15. *For citation.* (Для цитирования. Шрифт – 12 пунктов, прямой, межстрочный интервал – 1, выравнивание по ширине страницы. Дается библиографическое описание статьи (подробнее о правилах библиографических описаний см. п. 18)).

Образец оформления:

For citation: Author A. A., Author B. B. Title of article. *The Education and Science Journal*. 20XX; 24 (1): …–…. DOI: …

16. ОСНОВНОЙ ТЕКСТ. Объем – не менее 25, но не более 35 страниц, включая таблицы, рисунки и список использованных источников (шрифт – 14 пунктов, межстрочный интервал – 1,5, выравнивание по ширине страницы).

Рукопись (основной текст) статьи может быть представлена на русском или английском языке. Основной текст должен быть разбит на разделы, которым следует дать краткие заголовки. Структурирование текста может зависеть от направленности (эмпирической или теоретической) исследования. Эмпирические исследования должны соответствовать формату IMRAD. Теоретические исследования могут иметь авторскую логику Основной текст эмпирического исследования излагается на русском или английском языках в следующей последовательности:

1. **Введение** (**Introduction**).
2. **Обзор литературы** (**Literature review**).
3. **Методология**, **материалы и методы** (**Methodology, materials and methods**).
4. **Результаты исследования (Results).**
5. **Обсуждение (Discussion**).
5. **Заключение** (**Conclusion**).

Все части требуется выделять соответствующими подзаголовками и излагать в данных разделах релевантную информацию.

1. **Введение** (1–2 с.) должно содержать информацию, позволяющую читателю понять ценность представленного в статье исследования без дополнительного обращения к другим источникам. Следует обозначить актуальность поднимаемой научной проблемы,важность поиска ее решения для развития определенной отрасли науки или практической деятельности. Далее раскрывается теоретическая и практическая значимость работы с указанием вопросов, на которые пока нет четких научно обоснованных ответов и которые собирается рассмотреть автор (-ы). В завершение формулируются цель статьи, исследовательские вопросы, гипотеза и ограничения исследования, вытекающие из поставленной научной проблемы.

2. **Обзор литературы** (1–2 с.). Необходимо описать основные исследования и публикации, на которые опиралась работа автора, историю проблемы и современные взгляды на нее, трудности ее разработки; выделить в общей проблеме аспекты, освещающиеся в статье. Желательно рассмотреть не менее 25–30 источников (50 % которых должны быть англоязычными) и сравнить взгляды авторов, причем не менее 70 % анализируемых источников должны быть изданы после 2015 года. Ф. И. О. авторов цитируемых работ рекомендуется указывать на языке оригинала цитируемой статьи. *Например: как отмечает K. Furs [ ], по мнению А. Л. Сидорова … [ ]*

3. **Методология**, **материалы и методы** (1–2 с.). Описываются особенности организации проведенного исследования: его методологическая база, использованные автором методологические подходы и методы (эксперимент, моделирование, опрос, тестирование, наблюдение, анализ, обобщение и т. д.) и методики с обоснованием их выбора.

Представляется состав участников, место, время и последовательность выполнения исследования, а также применявшийся дополнительный инструментарий (программное обеспечение, аппаратура и пр.).

4. **Результаты исследования** – основной раздел публикации, цель которого – при помощи анализа, обобщения и других методов обработки полученных научным путем достоверных данных аргументированно доказать рабочую гипотезу (-ы). Систематизированный аналитический и статистический материал может быть представлен в виде «доказательств в свернутом виде»: таблиц, графиков, схем и рисунков. Важно помнить, что не нужно включать ссылки в этот раздел; поскольку представляются только собственные оригинальные результаты. Ссылаться на другие работы принято в разделе «Обсуждение результатов». Все названия рисунков, графиков, таблиц, схем, комментарии внутри рисунков и таблиц оформляются на русском и английском языках.

5. **Обсуждение результатов**. В этом разделе нужно объяснить значение полученных результатов для исследователей из разных стран: подчеркнуть важность своего исследования и то, как оно может способствовать пониманию существующей в мировом научном пространстве общей проблемы. Следует сопоставить свои результаты с ранее опубликованными работами ученых из разных стран мира, указать, как результаты исследования помогли заполнить пробелы в научной литературе, которые ранее не были раскрыты или учтены.

6. **Заключение**. В этом разделе необходимо соотнести полученные результаты с заявленными во введении целью и гипотезой, кратко ответить на поставленные исследовательские вопросы. Уместно подчеркнуть научную и практическую значимость проведенного исследования и спрогнозировать возможные варианты развития или решения проблемы.

17. Подготовка данных. Иллюстрации, включая рисунки и таблицы, являются наиболее эффективным способом представления результатов. Иллюстрации не должны дублировать информацию, описанную в тексте. Подписи к рисункам и таблицам должны быть самодостаточными и выполненными на двух языках (русском и английском), не требующими пояснений в тексте.

✓ Объемные материалы следует включить в качестве дополнительного материала (supplementary material). Они будут размещены на сайте издания.

✓ Желательно представлять цветной вариант рисунков для онлайн-версии журнала и PDF-файлов и черно-белый для печати.

✓ Следует учитывать размер шрифта в иллюстрациях после форматирования журнала.

18. Список использованных источников на русском языке – 30–40 публикаций, из них не менее 50 % зарубежных, изданных после 2015 г. Список формируется **в соответствии с последовательностью упоминания источников в тексте статьи** (шрифт – 12 пунктов, прямой, межстрочный интервал – 1, выравнивание по ширине страницы).

ЭЛЕКТРОННЫЕ ССЫЛКИ ДОЛЖНЫ ОТКРЫВАТЬСЯ – ОБЯЗАТЕЛЬНО ПРОВЕРЯЙТЕ!!!

В тексте статьи ссылки на использованные источники следует указывать арабскими цифрами согласно порядковому номеру в указанном списке. Номер ссылки и страницы цитируемого источника заключаются в квадратные скобки.

Источники в списке не должны повторяться! При повторных обращениях к одному и тому же источнику используется уже присвоенный выше номер ссылки.

ВНИМАНИЕ! В списке источников нежелательны ссылки на диссертации и авторефераты диссертаций, так как они расцениваются как рукописи и не являются печатными источниками. Авторам рекомендуется ссылаться на оригинальные статьи диссертантов по теме диссертационной работы.

Если *ссылки на диссертации и авторефераты необходимы, их, как и ссылки на документы и издания, не имеющие авторства, следует оформлять в виде сносок в тексте статьи*.

Примеры оформления литературы на русском языке

1. Белякова Е. Г. Смыслоориентированная педагогическая позиция // Педагогика. 2008. № 2. С. 49–54.

2. Загвязинский В. И. Наступит ли эпоха Возрождения? Стратегия инновационного развития российского образования. 2-е изд. Москва: Логос, 2015. 140 с.

3. Загвязинский В. И. Стратегические ориентиры развития отечественного образования и пути их реализации // Образование и наука. 2012. № 4 (93). С. 3–16. DOI: 10.17853/1994–5639–2012–4-3–16

4. Platonova R. I., Levchenkova T. V., Shkurko N. S., Cherkashina A. G., Kolodeznikova S. I., Lukina T. N. Regional Educational Institutions With in Modern System of Education // IEJME-Mathematics Education. 2016. № 11 (8). P. 2937–2948.

5. Мухорьянова О. А., Недвижай С. В. Роль образовательных учреждений в развитии идеи социального предпринимательства среди молодежи [Электрон. ресурс] // Вестник Северо-кавказского гуманитарного института. 2015. № 3 (15). Режим доступа: http://www.skgi.ru/userfiles/file/%e2%84% 96%203(15).pdf (дата обращения: 18.02.2016).

6. Flavell J. H. Metacognition and cognitive monitoring: a new area of cognitive developmental inquiry // American Psychologist. 1979. № 34. P. 906–911. Available from: http://jwilson.coe.uga.edu/EMAT7050/Students/Wilson/Flavell%20(1979).pdf (date of access: 10.12.2021).

7. Еремин Ю. В., Задорожная Е. И. Виртуальное обучение иностранному языку как один из способов решения проблемы компьютерной зависимости младших школьников // Герценовские чтения. Иностранные языки: материалы межвузовской научной конференции, 14–15 мая 2015 г. Санкт-Петербург: РГПУ им. А. И. Герцена, 2015. С. 265–266.

18. Список литературы на английском языке (REFERENCES)

Структура библиографических описаний на английском языке в **References** отличается от предписанной российским ГОСТом. При оформлении References следует придерживаться Ванкуверского стиля (Vancouver bibliographic style: http://guides.lib.monash.edu/citing-referencing/vancouver).

Названия журналов и других периодических изданий в описаниях статей выделяются курсивом и не отделяются знаком //, как в русскоязычном варианте.

Для транслитерации русского текста в латиницу рекомендуем использовать сайт http://www.translit.ru

Примеры оформления литературы на английском языке

Описание статьи

Format: Author A. A., Author B. B., Author C. C., Author D. D. Title of article. *Title of journal*. Date of publication Year Month (первые три буквы названия месяца) Date (далее сокр. YYYY Mon (abb.) DD); volume, number (issue number): pagination (page numbers).

(*Формат:* Автор А. А., Автор Б. Б., Автор В. В. Название статьи. *Название журнала*. Дата публикации (год или год, месяц, число); том, номер выпуска: номера страниц.)

Examples (Примеры):

Efimova S. A. Academic and professional qualifications of graduates of the system of secondary vocational education. *Obrazovanie i nauka (транслит) = The Education and Science Journal* (англ. вариант названия журнала). 2021; 23 (1): 68–82. (In Russ.)

Horsburgh M., Ladmin R., Williamson E. Multiprofessional learning: The attitudes of medical, nursing and pharmacy students to shared learning. *Blackwell Science Ltd MEDICAL EDUCATION.* 2001; 35 (9): 876–883.

Описание статьи из электронного журнала

Format: Author A. A., Author B. B. Title of article. *Title of Journal* [Internet]. Date of publication YYYY Mon (abb.) DD [cited (указывается дата обращения к источнику) YYYY Mon (abb.) DD]; volume, number (issue number): pagination (page numbers). Available from: URL

(*Формат:* Автор А. А., Автор Б. Б., Автор В. В. Название статьи. *Название журнала* [Internet]. Дата публикации (год или год, месяц, число [YYYY Mon (abb.) DD]); номер выпуска: страницы. Available from: интернет-адрес).

Examples (Примеры):

Demenchuk P. Yu. Educational cluster as an institutional system for the integration of education. *Integracija obrazovanija (транслит) = Integration of Education* (англ. вариант названия журнала) [Internet]. 2013 [cited 2019 Apr 17]; 4. Available from: http://cyberleninka.ru/article/n/obrazovatelnyy-klaster-kak-institutsionalnaya-sistema-integratsii-obrazovaniya (In Russ.)

Moscovici S. Social representations theory: A new theory for media research. *Nordicom Review* [Internet]. 2011 [cited 2019 Sep 8]; 32 (2): 3–16. Available from: http://yandex.ru/clck/jsredir?bu=47ul3e&from=yandex.ru%3Bsearch%2F%3Bweb%3B%3B&text=&etext=5277.0pQXZvh0d

Описание материалов конференций

Format: Author A. A. Title of paper. In: *Title of book. Proceedings of the Title of the Conference*; Date of conference; Place of Conference. Place of publication: Publisher's name; Year of Publication. Pagination (page numbers).

(*Формат:* Автор А. А. Название статьи. In: *Название сборника. Материалы конференции (название конференции)*; дата конференции; место ее проведения. Место издания: Издательство; год публикации. Стр. (количество страниц в сборнике или номера страниц).

Examples (Примеры):

Markic S., Eilks I. A mixed methods approach to characterize the beliefs on science teaching and learning of freshman science student teachers from different science teaching domains. Ed. by Taşar M. F.

& Çakmakci G. In: *Contemporary Science Education Research: Teaching. A Collection of Papers Presented at ESERA 2009 Conference*; 2010; Ankara, Turkey. Ankara, Turkey: Pegem Akademi; 2010. p. 21–28.

Rosov N. H. Mathematics course of secondary school: Today and the day after tomorrow. In: *Zadachi v obuchenii matematike: teoriya, opyt, innovatsii. Materialy Vserossiyskoy nauchno-prakticheskoj konferencii (транслит) = Problems in Teaching Mathematics: Theory, Experience, Innovation. Materials of All-Russian Scientific Practical Conference*; Vologda; 2007. Vologda: Publishing House Rus'; 2007. p. 6–12. (In Russ.)

Описание материалов конференций (Интернет)

Format: Author A. A. Title of paper. In: *Title of Conference* [Internet]; Date of Conference; Place of Conference. Place of publication: Publisher's name; Date of Publication [YYYY Mon (abb.) DD]; pagination (page numbers). Available from: URL

(*Формат:* Автор А. А. Название статьи. In: *Название конференции* [Internet]; дата конференции; место проведения конференции. Место издания: Издательство; год публикации [cited (указывается дата обращения к источнику) YYYY Mon (abb.) DD]; страницы. Available from: интернет-адрес)

Examples (Примеры):

Bespalova N. R. Parents' attitude to preschool education and upbringing quality. In: *Lichnost', sem'ja i obshhestvo: voprosy pedagogiki i psihologii: sbornik statej po materialam XV mezhdunarodnoj nauchno-prakticheskoj konferencii. Ch. II. Novosibirsk: SibAK, 2012 (транслит) = XV International Conference on Personality, Family and Society: Issues of Pedagogy and Psychology* [Internet]; 2012; Novosibirsk. Novosibirsk: Publishing House SibAK; 2012 [cited 2017 May 17]; 400 p. Available from: http://sibac.info/conf/pedagog/xv/27821 (In Russ.)

Potocnik J. European Technology Platforms: Making the Move to Implementation. In: *Conference on Social Sciences and Humanities – European Parliament. Seminar with Industrial Leaders of European Technology Platforms* [Internet]; 2005 Dec 16; Brussels. Brussels [cited 2016 Dec 10]. Available from: https://ec.europa.eu/ european-technology-platforms-makingmove-implementation

Описание книги (монографии, сборники)

Format: Author A. A. Title of book. Number of edition [if not first]. Place of Publication: Publisher; Year of publication. Pagination (page numbers).

(*Формат:* Автор А. А. Название книги. Номер издания (если не первое издание). Место издания: Издательство; год публикации. Стр. (количество страниц в книге или номера страниц).

Examples (Примеры):

Khotuntsev Y. L. Tehnologicheskoe i jekologicheskoe obrazovanie i tehnologicheskaja kul'tura shkol'nikov *(транслит)* = Technology and environmental education, and technological culture of students. Moscow: Publishing House Eslan; 2007. 181 p. (In Russ.)

Bloom W. Personal identity, national identity and international relations. Cambridge: Cambridge University Press; 2011. 290 p.

Описание книги, размещенной в сети Интернет

Format: Author A. A. Title of book [Internet]. Place of Publication: Publisher; Year published [cited (указывается дата обращения к источнику) YYYY Mon (abb.) DD]. Pagination (page numbers). Available from: URL … DOI: (if available)

(*Формат:* Автор А. А. Название книги [Internet]. Место издания: Издательство; год публикации [cited (указывается дата обращения к источнику) YYYY Mon (abb.) DD]. Стр. (количество страниц в книге или номера страниц). Available from: интернет-адрес. DOI: (если есть)

Examples (Примеры):

Maslow A. G. Motivacija i lichnost' *(транслит)* = Motivation and personality [Internet]. Moscow: Publishing House Direkt-Media; 2008 [cited 2019 May 20]. 947 p. Available from: https://litra.pro/motivaciya-i-lichnostj/maslou-abraham/read# (In Russ.)

Bainbridge W. S. Technological determinism in construction of an online society. Virtual Sociocultural Convergence [Internet]. New York: Springer; 2016 [cited 2018 Feb 10]. p. 25–43. Available from: https://doi.org/10.1007/ 978–3–319–33020–4_2

19. Авторская справка на русском языке

Информация об авторе (***авторах***)***:***

Ф. И. О. полностью – ученые степень и звание, должность, полное название организации, в которой работает автор; ORCID, ResearcherID (если есть); город, страна. E-mail: …

20. *Вклад соавторов.* (Рекомендуется указать, если авторов несколько.)

Порядок описания фактического участия в выполненной работе соавторы статьи определяют самостоятельно.

21. Авторская справка на английском языке

Information about the author (s): (Информация об авторе (авторах))

…… (Оформляется аналогично русскому варианту.)

22. *Contribution of the author (s):* (Вклад соавторов)

…… (Оформляется аналогично русскому варианту.)

При предъявлении статьи авторы должны подтвердить ее соответствие нижеследующим требованиям:

1. Статья ранее не была опубликована, а также не представлена для рассмотрения и публикации в другом журнале.

2. Файл со статьей представлен в формате документа Microsoft Word.

3. Приведены полные интернет-адреса для ссылок там, где это необходимо.

4. Основной текст набран с полуторным межстрочным интервалом, шрифтом в размере 14 пунктов; для выделений использован курсив, а не подчеркивание (за исключением интернет-адресов); все иллюстрации, графики и таблицы расположены в соответствующих местах текста, а не в конце документа.

5. Текст соответствует всем остальным, в том числе библиографическим требованиям, перечисленным в Правилах для авторов, размещенных на странице «О журнале».

В случае несоблюдения перечисленных выше требований рукопись будет отклонена редакцией

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The email should contain the author's mobile phone and e-mail address. Receipt will be confirmed by an automatically generated notification.

The submitted articles should include the following essential components:

– Clear identification of the research purpose and its relevance to current scientific issues;

– Extensive analysis of previous research in the field;

– Detailed presentation of research materials and research findings;

– Research conclusions and implications for further research.

Formatting requirements:

• File format – **MS Word (*.rtf)**;

• Font – Times New Roman;

• Font size – **14 pt;**

• Spacing – **1.5 lines;**

• Paragraph indention – **1.27 cm;**

• Margins – **2 cm;**

• Alignment – justified;

• Hyphenation mode – automatic;

• Emphasis – italic or bold;

• Text references – in square brackets with a reference number and quoted page number;

• Hyphens – distinguished from dashes;

• Dashes and inverted commas to be used consistently throughout text;

• Type styles and columns are to be avoided;

• No extra line spaces between paragraphs;

• Figures – black and white, without halftones, in graphic vector formats, such as WMF, EMF, CDR or AI;

• Raster (bitmap) – in TIFF, JPG formats at a minimum resolution of 300 dots per inch (dpi);

• Diagrams from MS Excel and MS Visio programs should be supplied in original file form.

• Formulas are typed using MathType only. Linear formulas are typed on keyboard (not in a mathematical editor).

Text Structure

1. UDC (refer to the Universal Decimal Classification http://teacode.com/online/udc/) (Font size 14, bold, left alignment)

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The title should be concise and informative (less than 10 words), clearly conveying the essential research findings.

3. Author names (Font size 12, bold, right alignment)

Author names should be presented in the following order: **First name, middle name (initial), surname**.

Authors' names should be separated by commas.

4. Author affiliation (Font size 12, light italic, right alignment)

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Use **a shared affiliation** when the authors have the same institution.

Format:

X. X. Xxxxxxxx
Krasnoyarsk State Pedagogical University named after V. P. Astafiev, Krasnoyarsk, Russia.
E-mail: xxxxxxxxxxx
X. X. Xxxxxxxxx[1], X. X. Xxxxxx[2]
Gdansk University of Physical Education and Sport, Gdansk, Poland.
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5. *Abstract.* (Font size 12, line spacing – 1, justified alignment). The abstract should be between 350–400 words in length.

The abstract plays the role of an enhanced title, providing essential information about the article content.

Abstract structure:

• *Introduction.* (Dedicate at least a few sentences to providing the context or background of the research paper, to explaining any motivation for conducting that specific research, and to identifying the significance of the research and how it aims to fill a research gap.)

• *Aim(s).* (Consider the aims and intentions of the study as well as outline any important questions or hypotheses.)

• *Methodology and research methods.* (Use this section to concisely justify and identify your study's approaches, methods, design aspects, key variables and any relevant data-analysis procedures.)

• *Results.* (Present the main findings and results of the research's key aims, questions and hypotheses, as well as provide some discussion of any additional considerations that were encountered during the research process.)

• *Scientific novelty.* (Refer to one or elements that are new in the research, including new methodology or new observation, which leads to a new knowledge discovery in the theory of pedagogy and education, as well as related scientific industries.)

• *Practical significance.* (Highlight practical suggestions for application of the research or implications for future research.)

6. *Keywords.* (Font size 12, line spacing – 1, justified alignment)

Keywords are one of the most important factors in the discoverability of scientific articles indexed in bibliographic databases. The paper should contain a list of 5–10 keywords, which reflect the research problem, achieved results and applied terminology.

7. *Acknowledgements.* (Font size 12, line spacing – 1, justified alignment)

When acknowledging, thank all those who have helped in carrying out the research (chairs, supervisors, funding bodies, or other academics, e.g. colleagues or cohort members).

It is a common practice for authors of an academic work to thank the anonymous reviewers at the journal that is publishing it.

8. *For citation:* (Font size 12, line spacing – 1, justified alignment). A bibliographic citation provides relevant information about the author(s) and publication (author name(s), article title, journal name, publication year, volume and issue number, page range of the article, and article DOI).

Format:

For citation: Author A. A., Author B. B. Title of article. *The Education and Science Journal*. 20XX; 24 (1): …–…. DOI:

Sections 2–8 (paper title, author names, author affiliation, abstract, keywords, acknowledgements, bibliographic citation) **should be provided in Russian using the same text structure and requirements.**

9. Body text (Font size – 14 points, line spacing – 1.5, justified alignment)

The paper should be between 25–35 pages, including tables, figures and references. In some exceptional cases, when the work represents great scientific value, larger manuscripts can be considered.

The manuscript (body text) of the article may be presented in Russian or in English. The manuscript should be divided into clearly defined sections. Subsections should be given a brief heading. Manuscripts should be structured according to whether their subject matter is of an empirical or theoretical nature. Empirical works must conform to the IMRAD format, whereas those having a theoretical character may be constructed following the relevant logic of argumentation.

Order of sections in the IMRAD format:

1) Introduction.

2) Literature Review.

3) Methodology, Materials and Methods.

4) Results and Discussion.

5) Conclusion.

1) ***Introduction*** **(1–2 pages)** announces the research problem and its relevance to current theoretical and practical issues in the field. It establishes the scope and context of the research by analysing the most relevant publications on the topic being investigated. The Introduction conventionally leads the reader from the general background information describing the current research focus in the field and specific terminology, through identification of a research problem or gap in the existing knowledge to a statement of the aims and objectives of the paper. It is of importance to highlight the potential outcomes and implications for further research.

2) ***Literature Review*** (1–2 pages) critically surveys scholarly papers and other sources relevant to the problem being investigated. This section is designed to provide an overview of literature the author studied while researching the topic and to demonstrate how the work fits within a larger field of study. It is common practice to overview no less than 20–40 publications, with the majority of them to be retrieved from international English-language sources.

3) ***Methodology, Materials and Methods*** (1–2 pages) section presents actions taken to study the research problem and the rationale behind the application of specific procedures, such as observation, survey, test, experiment, analysis and modelling. This information should be detailed enough for an interested reader to understand the principles that allowed the researcher to select, process and analyse data pertaining to the phenomenon under study. This section provides the information by which the overall validity of the work can be judged. Where the study is aimed at developing a particular model, it should be detailed in this section. The authors' names should also be integrated into the text, e.g. *Scholtz [1] has argued that …*

4) ***Results and Discussion*** (varies in length depending on the amount of information to be presented) reports the findings of the study and provides their evidence-based interpretation. In this section,

the working hypotheses underpinning the study are either confirmed or rejected. A comprehensive and objective description of the research results allows the reader to follow the logic of argumentation that the author applied when analysing the obtained data. It is important to be concise and avoid presenting information that is not critical to answering the research question. The research findings are conventionally supported by non-textual elements (tables and figures) in order to further explicate key results. The most significant results are given critical consideration in the text. It is desirable that the results presented in the article be compared with those obtained in other studies. Such comparisons can be helpful in describing the significance of the study in terms of how its findings fill existing gaps in the field. This section is considered to be the most important part of the research paper because it reveals the underlying meaning of the study and formulates a more profound understanding of the research problem under investigation.

5) ***Conclusion (2–3 paragraphs)*** **is not a mere summary of** research results; rather, it is a synthesis of main points. It highlights key findings by noting their important theoretical and practical implications. A synthesis of arguments presented in the text should be provided to demonstrate how they converge to address the research aim stated in the Introduction. Directions for future research should also be outlined.

10. Data preparation. Illustrations, including figures and tables, are the most effective way to present results. Illustrations should not duplicate the information described in the text. Information in figures and tables should be clear that do not require further explanations in the text. Each table or figure should be displayed with a clear and concise title.

✓ Additional data or materials can be included as a supplement to a manuscript. Such materials will be posted on the Education and Science Journal website.

✓ It is desirable to provide colour images for the electronic edition of the Journal and PDF files and black and white images for a printed version.

✓ Note the font size in illustrations after formatting and converting.

11. References (Font size – 12 points, line spacing – 1, justified alignment)

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Examples:

Efimova S. A. Academic and professional qualifications of graduates of the system of secondary vocational education. *Obrazovanie i nauka = The Education and Science Journal*. 2021; 23 (1): 68–82. (In Russ.)

Horsburgh M., Ladmin R., Williamson E. Multiprofessional learning: The attitudes of medical, nursing and pharmacy students to shared learning. *Blackwell Science Ltd MEDICAL EDUCATION*. 2001; 35 (9): 876–883.

Journal titles are not abbreviated.

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Examples:

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Moscovici S. Social representations theory: A new theory for media research. *Nordicom Review* [Internet]. 2011 [cited 2019 Sep 8]; 32 (2): 3–16. Available from: http://yandex.ru/clck/jsredir?bu=47ul3e&from=yandex.ru%3Bsearch%2F%3Bweb%3B%3B &text=&etext=5277.0pQXZvh0d-

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Rosov N. H. Mathematics course of secondary school: Today and the day after tomorrow. In: *Zadachi v obuchenii matematike: teoriya, opyt, innovatsii. Materialy Vserossiyskoy nauch.-prakt. konf. = Problems in*

Teaching Mathematics: Theory, Experience, Innovation. Materials of All-Russian Scientific Practical Conference; Vologda; 2007. Vologda: Publishing House Rus'; 2007. p. 6–12. (In Russ.)

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Potocnik J. European Technology Platforms: Making the Move to Implementation. In: *Conference on Social Sciences and Humanities – European Parliament. Seminar with Industrial Leaders of European Technology Platforms* [Internet]; 2005 Dec 16; Brussels. Brussels; 2005 [cited 2016 Dec 10]. Available from: https://ec.europa.eu/ european-technology-platforms-makingmove-implementation

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Bloom W. Personal identity, national identity and international relations. Cambridge: Cambridge University Press; 2011. 290 p.

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Bainbridge W. S. Technological determinism in construction of an online society. Virtual Sociocultural Convergence [Internet]. New York: Springer; 2016 [cited 2018 Feb 10]. p. 25–43. Available from: https://doi.org/10.1007/ 978–3-319–33020–4_2

12. Information about the author(s) (Font size – 12 points, justified alignment)

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