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Intelliquiz — A Gamified Adaptive Quiz Generator Using Llms with Real-Time Analytics

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Abstract: Honestly, I've seen that most schools are still based on blunt tests and even though they make the exams are the same whether it is a person who is answering it but at his own pace, it's a bad thing when people learn at different pace. One tool taking the game far further is IntelliQuiz which automatically generates entirely new quizzes using AI and sprinkles in some gamifying fun as well to keep things as interactive as possible. Instead of offering one format, it will take material from PDFs, videos and even just plain text, to construct its questions that shift in real time during class, based on how each student is doing. Harder questions pop up after a correct answer the easier ones pop up if someone's struggling. Behind the curtain, the system has a combination of Spring Boot to manage server-related operations, React with Tailwind for frontend styling and storing everything in a PostgreSQL database. Access control divides the users into three groups namely Admin, Teacher and Student as per which they are provided only the permission as secured tokens. The engine really stands out because it fits large language models with retrieval methods to bring facts in into the room before generating the questions so that any prompt will be linked back to specific learning objectives and kept on point. The challenge scales over the levels of beginners, intermediaries and experts automatically without additional effort from teachers. It even tweaks questions on the fly based on how fast a learner is answering, the success rate and how his summers are without having to work on the testing questions instead of fixed testing questions, round by round helps to form itself around what a user actually knows. Points, badges and leaderboards pop-up as the progress is made encouraging that little quiet competition that keeps the attention wired. Live charts are updated as the activity comes through illustrating the gaps, the strengths and patterns. One benefit of this is that teachers may recognize trends early and students may realize where they want to expend their energy. The modular aspect to this means it can scale up very easily and shift very easily from one device to another including network condition. Every answer generated by AI gets screened first: it gets double checked before making its way to a student meanwhile the logic behind each score is traceable with difficulty weighed and usefulness measured. Regardless of whether the solution is online or offline, on the school servers or in a University data center, the solution remains lightweight. The time which until used to manually build quizzes now gets freed up via smart automation. Grading occurs plainly and obviously, comments are specific, and monitoring is close always using gripping levels of tracking. As validation is built in along the way, the trust is intact as the system becomes faster. Learning isn't simply tracked it changes itself in real-time according to personal rhythm, pace, depth and direction. It's not some type of magic or noise, it's a constant consistency between effort and growth.

Keywords: Adaptive Learning, Large Language Models (LLMs), Retrieval-Augmented Generation (RAG), Gamification, Automated Quiz Generation, Real-Time Analytics, Educational Technology, Personalized Assessment.

I. INTRODUCTION

Machines are now able to learn on their own, making factories become faster at thinking and which can adapt more rapidly, but schools are yet to adopt such tools. The seamless integration of robots, sensors, and live feedback loops also characterize production lines but are very rare in classrooms that provide tech that changes as well to the pace of individual learners. Rather than fixed tests, consider systems that are adapted by in-flight decisions, just the way assembly units re-achieve mid-cycle reconfigurations. As

software picks up on each student movement, responses become more responsive - like intelligent plants that become more efficient by continuously feeding on data. The accuracy that is the province of circuits and code would steer grading, which can be given that opportunity.

The majority of the quizzes of old style remain the same, and do not change in difficulty no matter who might be answering. However, the outcome of the students varies, as different students demonstrate, which is not aided by standard tests. Hand grading differs, teachers spend hours in coming up with exams - grading is a close second. Feedback is at times too late since everything is done at dotted intervals. This is where software comes in, which is adaptable on its own according to actual feedback. IntelliQuiz is a new device whereby questions are dynamically shaped with the help of smart code. Scoring is done by machines and the patterns of attempts are followed. It uses previous questions to form the next question as opposed to a one-size-fits-all. Design is a combination of the automated workflow with decision logic within the same platform. Educators get to relax; learners have pockets of difficulty that suit them.

Through uploaded learning contents, it extracts the important information using smart language tools with real-time fact-checking mechanisms. Constructed as a highly sensitive piece of measuring equipment, every step examines itself to make sure there is clarity in it, sense in it, and that the subject is what is being measured. Difficulty changes dynamically when the question is used - slower responses or errors bias the questions to easier forms. Precision affects each of the layers, not only in accuracy when using language; it determines the flow of logic between individual ideas. In the background, previous history, as well as speed, informs future action.

II. LITERATURE REFERENCES

[1] Chaudhary and team in 2025 introduced a smart knowledge platform powered by artificial intelligence. Built on NLP tools like BERT and GPT-4, it creates questions automatically while tuning their complexity. Instead of fixed rules, reinforcement learning shapes each query based on how well users perform. The output stays sharp and relevant - yet feeding the model demands massive data volumes. Heavy computational needs tag along, too. Because of these demands, running it smoothly during live classroom sessions becomes tough. Most schools simply lack the infrastructure needed for instant scaling. Even with strong results, access remains limited under normal educational conditions.

[2] Singaravel and team in 2025 introduced a tool making smart multiple choice questions by combining retrieval-augmented generation with deep prompting strategies such as step-by-step logic and self-correction loops. Built into it is an ability to shape questions based on how learners answered before, keeping the material close to what they've seen. Still, their work points out something missing - tools that track progress over time and elements that make practice feel more interactive. IntelliQuiz fills that space using dashboards that shift with user behavior, along with ranking systems that spark subtle competition.

[3] Sreekanth and team in 2025 built an AI quiz tool called UC-100, powered by agents working together. Instead of one model doing everything, it splits tasks across parts - using LangChain for flow, FAISS to find relevant material, Gemini 1.5 to write questions. Accuracy jumped past 93 percent once context-aware fetching paired with internal checks kicked in. Because each step verifies before passing forward, mistakes dropped without slowing output. That design, where pieces operate but stay linked, shaped how IntelliQuiz later organized its own layers. One part grabs content, another forms queries, a third confirms quality, while logs track results behind the scenes. Not every system chains steps like this, yet the pattern proved reliable under testing.

[4] One big thing came up in Maity and Deroy's 2024 research - their project, called The Future of Learning in the Age of Generative AI, looked at how language models build tests on their own. These systems give tailored responses by thinking step-by-step without needing past examples. Even so, problems pop up when questions lean unfair or show bias. To help fix this, IntelliQuiz adds automatic reviews that spot weak spots in test items. Keeping things honest matters just as much as making them smart.

[5] After studying more than three thousand studies, Strielkowski and team in 2025 noticed a sharp rise in smart learning tools since the pandemic began. Their work showed tailored lessons powered by artificial intelligence can open doors for more learners while boosting results. Still, they stressed honesty around data use matters just as much as progress. Built into IntelliQuiz are safeguards like verified access, clear performance tracking, security-first data methods - because trust shapes technology's role in education.

[6] Starting off, Gómez Niño and team in 2024 looked closely at using AI to turn learning into a game. Instead of just listing results, they showed how adding challenges, scores, and rankings pulls students deeper into tasks. Because of this setup, learners tend to stick around longer, think more deeply, sometimes even come up with unusual ideas. Rather than copying old formats, their method weaves play-like features directly into smart quizzes that adjust on the fly. One example, IntelliQuiz, builds on those findings - not simply tagging rewards onto tests but blending them into the flow.

[7] Starting off, Weiß (2025) looks at how gamification together with adaptive learning grabs modern students' attention. Instead of traditional methods, schools are turning toward tech-driven tools that adjust on their own. One thing stands out: blending game-like features with smart algorithms helps tailor lessons smoothly. This mix doesn't just hold interest - it also opens doors for different kinds of learners. Behind IntelliQuiz's framework lies exactly this idea - shifting challenge levels while keeping interactions playful. Evidence from the research backs this up, showing stronger involvement when systems adapt and reward progress subtly. Not every method sticks, yet this combination proves steady in real classroom trials.

[8] Wang and colleagues, back in 2023, built a tool called iQS that slips AI-made quizzes into Moodle. Instead of one-size-fits-all tests, it shapes each quiz around what a learner knows - thanks to structured knowledge maps. Because of how it adapts on its own, students stayed more involved and remembered better. This lines up close with what IntelliQuiz aims for: smart, self-adjusting quizzes that grow without losing quality.

III. METHODOLOGIES

Content Ingestion and Preprocessing

- **Resource Upload and Parsing**

Within IntelliQuiz, books, article or lecture notes are dropped by teachers. After they have been posted, such tools as Apache PDFBox will extract the text automatically, no need of manual trimming. In this way, the system can be able to analyze and work with the material later.

Text cleaning and structuring

The messy bits? Gone in a flash - bizarre designs and sound are gone. Then gradually it shreds the info into subject-centric bits, without losing meaning to allow answers to remain meaningful in the future.

Semantic Search and Context Setup

- **Context Chunking**

The system picks out the content into small bite portions so that the model can only select what is necessary. The large model is divided into two rings to slices of clean substance, clear enough to be used to make solid answers.

Retrieval-Augmented Generation (RAG)

It is time to take a spin in another direction: grabbing info when the subject requests it. The search is guided by context ensuring that only the useful snippets are presented. The model answers sharp and accurate

before any question is even formed which is in the form of the top few hits.

AI-Based Quiz Generation

- **LLM Integration**

Big language models, such as Google Gemini or OpenAI, are used to make smart quiz creation. Prompt templates are baked to take into consideration the topic, difficulty and the cognitive level. Templates have been created in the pre-built form of the questions. Any question is developing around definite intention, no speculations.

Difficulty Tagging

There are already sorted questions which are easy, medium or hard depending on the concepts, level of thinking required, and the areas involved.

Question Validation

Auto-checked MCQs can be generated: correct, logical distractor, relevance to the subject and correct formatting of the answers. After the verification, every query is placed in PostgreSQL to be used in the future.
Adaptive Difficulty Engine

Performance Monitoring

Educators can see the progress of students overtime using correct answers. The speed, also, narrates about the learning patterns. History of quiz grade cumulatively creates a complete image. Updates happen constantly.

Dynamic Difficulty Adjustment

Where the difficulty is kept constant with set limits, the system changes: increased difficulty level implies harder tasks; reduced difficulty level implies easier tasks; an even performance level maintains the level of difficulty. The learning process occurs at a natural progression and hence the challenge follows suit and happens silently in the background.

Gamification Mechanism
Points and Badges

Right answer = point. Badges are acquired when the milestones are reached -long streaks, high accuracy, attendance.

Leaderboard System

The ranking of the top is dynamic as the students earn points creating a silent competition with rankings, which keeps on evolving.

Live Data Tracking and Updates
Performance Aggregation

The results of quiz are inputting into master reports: topic mastery, mastery by individual, mastery by class, accuracy and time reports.

Visualization

A React dashboard pops alive. Recharts is for active graph, no pictures, only dynamic data a drawing trend. Taps or scrolls respond to charts. There is no reloading of page as lines, bars and circles update in real time. Feedback shows immediately.

Web Application Integration
Backend Implementation

It is a full-fledged RESTful API that manages the login, quizzes, intelligent tweaks, and data tracking and is based on Spring Boot and Java 17 on the server side.

Frontend Implementation

New interface in React, programmed with Tailwind CSS. Dashboards slide efficiently through the devices, Admin, Teacher and then Student tailored. The views will automatically adjust according to the size of the screen, no strict layout will be left.

Role-Based Access Control

The use of tokens as a method of securing the log in is restricted to registered users: Admins, Teachers, Students.

Intelligent System Architecture

the quiz engine is connected to tools through a web hook, such as blocks on a Web table that are connected by digital table. There is a side that receives requests, and a side that verifies answers, each one performs its task individually, as if they were factories, without one carrying out the same task as the other. Open rules are rules in which the parts add or replace parts when necessary. Automation layers only signal on demand keeping all in compliance.

Data Acquisition Layer Content Ingestion

AI processing with models and retrieval

Adaptive Control Layer

Analytics and Monitoring Layer

User Interaction Layer

The system acts as a completely autonomous system that connects digital components such as those in factories nowadays. Everything communicates to all others with ease.

Testing and Checking How Systems Work

This is done through formal tests to ensure that all remains solid: API endpoint unit tests, integration tests between AI modules and DB, stress tests that ensure the quiz generation in real-time, auth and role control security tests. There is AI content correctness that is auto checked. Fine control maintains performance consistency, consistency in measurements whereas continuing operations in automated production without a problem.

Secure Reliable System Design

The data reliability begins with a strong verification in the storage level. Verification of identity Safety Security though tokens. The safeguarding of privacy does not bring about any slowness. The system records of activities are automated. Supervision can be done since each event bears an imprint.

IV. RESULTS

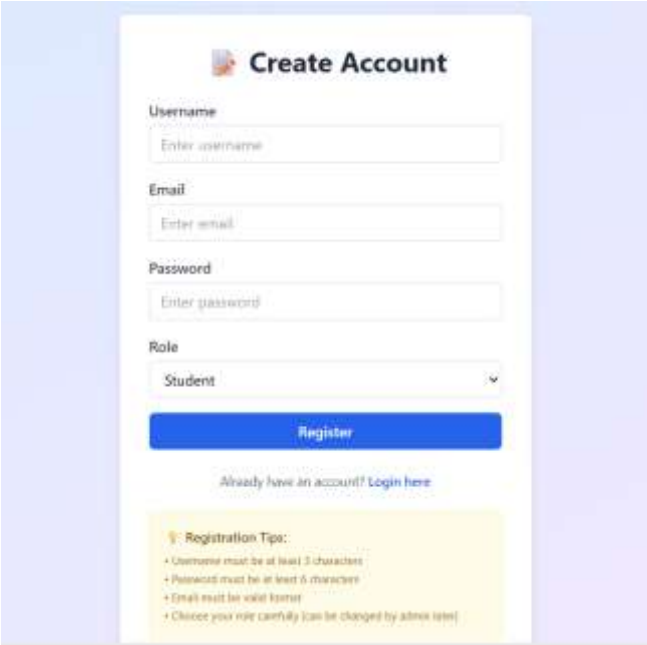

FIGURE. 1: Displays the sign-up page of IntelliQuiz, the initial page when signing into the platform. This is a starting point where individuals should fill in information required to create an account. One has to select whether they are Admin, Teacher or Student during set-up. Information is passed through security checks which are carried out in the background. Verification is done to keep fields right and clean. None of the improper inputs is allowed by the system before anything loads into place. This is the first page which it places on a front where it is connected to the structure beneath by the users.

FIGURE. 2: Views the login page of IntelliQuiz, a starting point that is a part of the system in which people demonstrate that they are who they say they are. Access starts at this point; users feed in information that corresponds to information in the storage. Checks are made in the background and one is only accepted by being recognized. Every stage facilitates safe interrelation without apparent complexity. The design blends into the overall functioning of the entire set-up. The what seems to be a simple thing does the accurate work discreetly. Entry requires that there should be a provision of the right information.

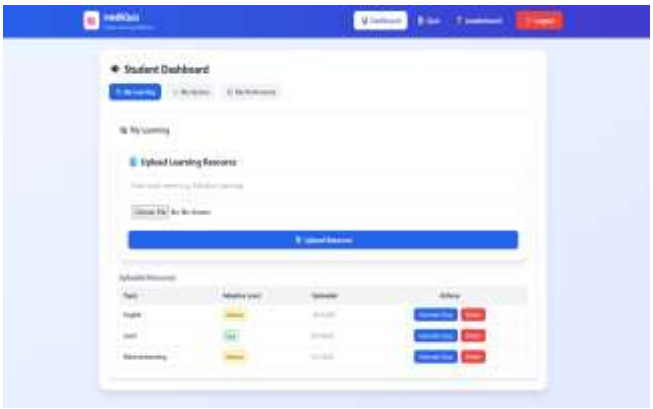

FIGURE. 3: Student looks at IntelliQuiz. Here we have a hub of centrality - this area runs most of the tests with the digital testing setup. Learners do not deal with static pages but engage with live tools, which react in real-time. Using this screen they manipulate study content using dynamic controls. The process of creation of the quiz starts with artificial intelligence services that the layout comprises. The period of progress tracking is repeated and varies with the performance during sessions. When updates are made in real-time, every learner will be updated on time.

FIGURE. 4: It demonstrates the pop-up that we can use to form quizzes in IntelliQuiz. This screen enables the students to configure their quiz and when questions are developed by artificial intelligence, there. They do not simply select the options, but rather create the appearance of the test. One of the decisions includes the choice of topic - what to researchers concentrate on. The other step determines the number of questions to show. Challenging can also be adjusted, it can be Easy, Medium or Hard. Even preferences of assessment type are determined here. Both environments are useful in customizing the experience. It is structured in such a way that only on the confirmation of these inputs, the entire process starts.

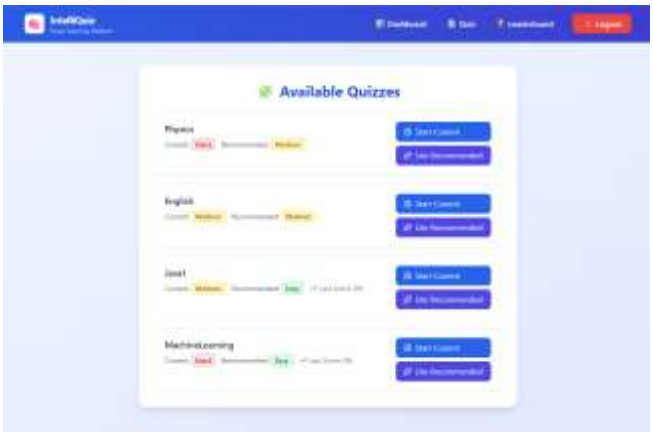

FIGURE. 5: When the user is at the IntelliQuiz, a list of quizzes can be observed on a screen. Here is the page, on which, learners choose assessments by topic or by class. The selections are presented in rows with such information as course title, its difficulty, previous attempts, grades. The selection of one provides the possibility to begin or to examination. Navigating through the tests is assisted by interface that rules filters based on type or progress.

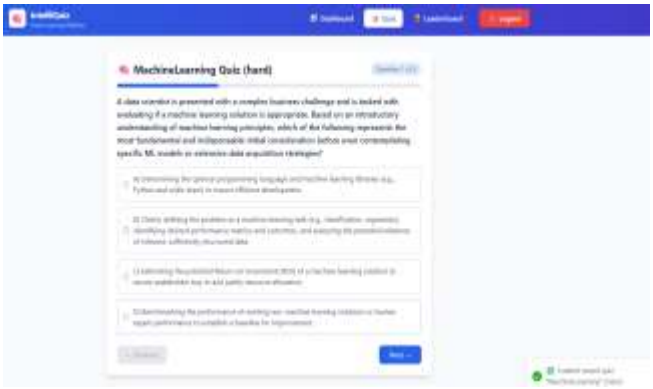

FIGURE. 6: It demonstrates the appearance of the quiz attempt screen on IntelliQuiz, a space that is designed in the smart digital installation in which testing is performed in real time. Artificial intelligence poses various problems to learners as multiple choice problems there. The challenge to this changes as we use it and is muted through an engine fine-tuning to change. Every question will change in response to the answer of a student, presenting an individual experience without the drawn attention and pomp. This is the interaction but not flash but consistent functionality.

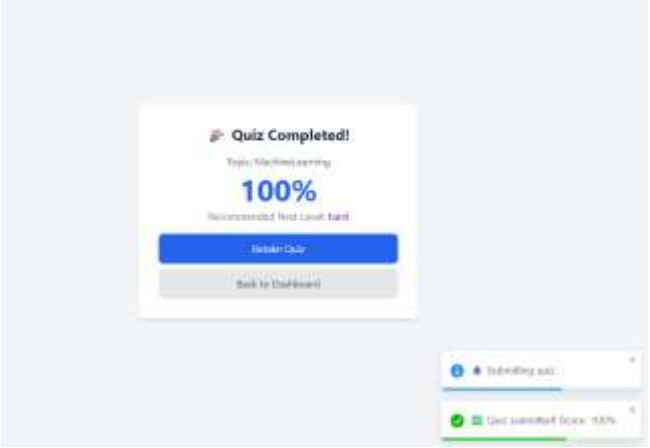

FIGURE. 7: Results are shown in a clear way providing immediate feedback. Strengths and gaps can be seen with a summary of performance. The number of points obtained is summarized at the top. Next is accuracy rate which is given in percent form. The stages of progress according to levels of difficulty demonstrate the change in the levels of challenges. The amount of time spent on a question is automatically checked. There is a highlight of results in each subject area. This perspective brings a structured understanding to an end.

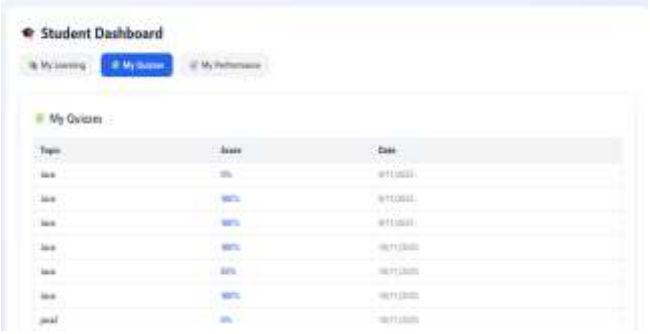

FIGURE. 8: It displays the view of the students when visiting "My Quizzes" within the dashboard of the IntelliQuiz. Within this space is an easy-to-follow map of previous quiz attempts. The entries fields contain such information as the name of the topic, the difficulty of the quiz, number of marks, percentage of correct answers, and precise data on dates and time when these quizzes were completed. All are kept grouped and thus it is easy to track developments overtime.

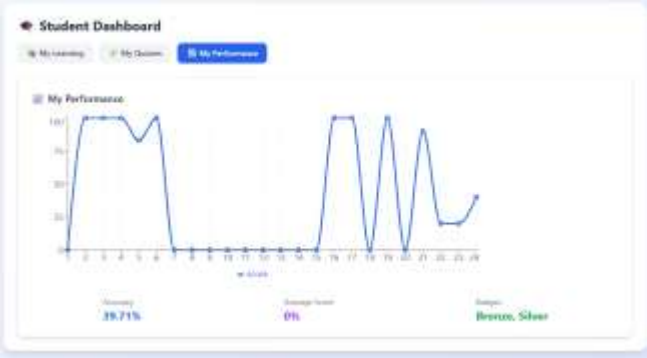

FIGURE. 9: It is the representation of the area of My Performance in the IntelliQuiz student dashboard. Not only points, but development in a number of quizzes can be found here. The progress can be observed by means of charts that are renewed after every attempt is complete. Patterns, not isolated outcomes manifest themselves over weeks. Learner gets to see the results of efforts. With every attempt, we receive information, creating an image clearer. Monitoring is a natural process, which does not require additional measures. Feedback remains related to actual activity. Previously achieved results are related to the current decisions. Growth is not an assumption - it is demonstrated. The most evident thing that evolves with time is what. In this way effort acquires the meaning.

V. CONCLUSION

Have you ever wondered what would happen to the old-fashioned quizzes should they be subjected to some technological upgrade? The IntelliQuiz project is flipped. The system adapts itself in accordance to our style of learning as opposed to the typical and common one size fits all. It is a massive language model-driven engine and could be termed as responsive and potentially accelerates or decelerates in the absence of the teachers. Process Tests are in paper format thus the paper is at the floor most of the time that it was obliged to update and to monitor all the times. IntelliQuiz does not want to be in those grounds of suffering. There is also a blend of real-time monitoring of information and adjustments that are made based on rules in order to maintain operations cool in the background.

It is used to retrieve information in lecture notes, research papers and even voice recordings of the same changed into text. The questions are not thrown at us without any rhyme and reason and that is why they adhere to the logic instructions which go in line with what was indeed being taught. Sumping factual information prior to formulating queries, it employs retrieval-enhanced methods and tools, which include Gemini Pro and OpenAI. Each of the outputs is filtered whereby the ideas remain true and can be identified by the source material. We will be able to teach more as we will not spend so much time preparing exams. The chain of checks which kills guesswork, but admits of variety of difficulty, hangs behind any question. Efficiency is not made by the shortcut nor is it made by the middle road, but by making the establishment of wiser ways through the learning material. And automated built-in reviews guarantee test accuracy, clarity and structure of each question, making testing accurate and credible.

The most inspiring fact is that IntelliQuiz has the Adaptive Difficulty Engine, that is, it is more like an intelligent arbiter amidst a feedback mechanism. It starts with observing our response rate, how many we nailed and our past performance and automatically optimizes the quiz to trail us. The rest of the world, to the precise factory technology and a responsive machine system, steals the ideas of this live tuning. Every learner works at his/ her pace, and levels of interest, memory and deep understanding in the mind are heightened. We are extracted through the use of points and badges and progress markers to bring in players through an amusing format. Board boards stir up just under-spoken competition without stressing us. The system gradually gets us into learning intelligent tracks and it occurs without much noise. By recalling to every subject: Teachers clearly understand the understanding per assignment and trend of the groups and the accuracy of the tracks cut.
Trends are dynamic taking place in time, showing their changes until they become gaps. Live updates enable teachers to enter at the appropriate time. All this is on

top of a good framework - Spring Boot with Java 17 handles any necessary core logic. React.JS renders the UI and they are in tandem with clean [tailwind] CSS layouts. PostgreSQL stores the data in a structured and ready format and expands as we expand. And to add all of that, they have a flexible backend which delivers web utility, log-in, quiz creation, as well as tweaking the difficulty in real-time and statistics of its use. It does not give the doors away to all people as with other systems but rather it employs secure tokens to isolate what admins, teachers and students can see and things locked down without interfering with slowing any system down.

It is aimed at online hosting, so it can easily adapt with the release of new features and remains light on resources so that both large and small schools can stay up-to-date. Testing is done in stages according to specific plans: the system is tested, the speed is measured, the safety holes are hunted, and the links are tested bit by bit. The rules of each of the layers are relatively mute like smart systems, where credibility and trust lies in demonstration, perpetual testing and tight feedback feedback loops building well-knit results. IntelliQuiz is a one step inventiveness of self-executive alertness system on exams- prompt response according to the needs of users. As an AI, it glides without friction, through real time data and does not follow set rules, and it verifies it through multiple overlay means in its architecture. Such an arrangement reduces the workforce of human beings and speeds up the feedback with customization of each student individually.

This natural development of connection between parts results in machines being smart, constant optimization, which is verified, combined with an immediate insight, all embedded within an interconnected digital structure. This integration goes on even further than the old forms, establishing a discipline in which educational technologies may grow as sheltered by evolving online learning classes, the long-term testing systems and even a generation of training that will fit the demands of current industries.

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It is wonderful to say Mrs. A. pavithra who is the guide to this project. She works in the Department of Information Technology in GRIET. Having a constant encouragement and supportive thought, she was kept in the loop at the beginning and the end. We came to clearer places in hard places because of her cutting remarks and thorough understanding. The thing that was remarkable was the fact that she stabilized us when the situation became hazy. Our working strength increased during her supervision. Concurrently, we began to view research differently - in a more understandable, serious manner.

The path leading the right was wiser as she passed part of it with us. The large part of the credit of this proposal is due to Dr. Y. J. Nagendra Kumar, who heads the department, and is a constant motivational factor with his stable advice and belief in us. We were on firm grounds as we were passing through every section of this project courtesy of his leadership. We are very grateful to Mr. P. K. Abhilash and Mrs. T. N. P. Madhuri, as well, as they were watching all the stages, intervening when necessary, and providing assistance that has indeed made a difference. In their absence, progress would not have been that easy. Heavy appreciations to Dr. Janddyala N.Murthy, Director, in GRIET and to Dr. J.Praveen, Principal - both took the trouble of providing space on which learning flourished.

Due to them, there was an easy flow of resources and progress was natural. Their consistent demand of new thought kept our efforts on the fire here and there. Shout -outs beside each faculty member, each on behind desks, at hallways at GRIET College in Hyderabad - help was silently arrived, frequently present, and even better than words. It was encouragement through talk on bad days, which had been keeping us going. This project could not have made it to see the end without their firm hand. Ultimately we owe a debt of gratitude to our classmates, our friends and our families that managed to lift our spirits when it got too low.

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5. W. Strielkowski and team, published in the Sustainable Development Journal in 2025. Their wide-ranging analysis tracks evolving patterns in adaptive learning technologies powered by AI. Ethics take center stage when rolling out these tools in classrooms. Clear handling of student information becomes a key theme throughout their findings. Insights emerge slowly, revealing concerns alongside progress.
6. J. R. Gómez Niño and team explore AI-driven game elements in education. Rather than just testing scores, their work tracks deeper involvement, memory strength, and thinking abilities over time. Through structured observation, they show shifts in student behavior when playful tech meets smart systems. Results appear across a 2024 issue of Computers, volume 13, number 12, pages 324 to 338. Engagement climbs not because tasks feel easier but because challenges adapt dynamically. Instead of passive reception, learners respond to evolving feedback loops built into activities. The full title - "Gamifying Learning with AI: A Pathway to 21st-Century Skills" - frames what follows without overstating outcomes.
7. F. Weiß explores how game-like features blend into modern education methods. Published in Digital First Magazine in 2025, it looks at current shifts shaping training environments. Instead of traditional formats, dynamic feedback loops shape student involvement. Rather than one-size-fits-all models, personalized paths adjust in real time. Engagement rises when challenges match individual skill levels. On top of that, rewards aren't just points - they reflect progress meaningfully. Because learning styles differ, flexibility becomes key. Through tailored experiences, more students stay involved. Behind the scenes, data guides adjustments without overt control. Ultimately, inclusion grows stronger when systems respond thoughtfully.
8. X. Wang and team looked at an AI quiz tool called iQS, published through DFKI in 2023. Built on

structured knowledge maps, the system shapes questions using artificial intelligence. Feedback adjusts to each student's progress inside learning management setups. Instead of fixed quizzes, responses guide what comes next. This approach links subject understanding with real-time output. Behind it all, rules define how topics connect. Unlike standard formats, the method tailors results dynamically. Because of its design, learners get input that matches their level. While many systems stay static, this one shifts based on performance. Through smart modeling, the gap between knowing and testing gets smaller.

9. R. Kumar's piece in the Indian Education Review (2025) digs into how AI shifts learning landscapes. Though global in reach, it zeroes in on India, where access still stumbles. Scaling up isn't smooth; tech bumps into real-world limits. Yet possibilities grow when smart systems meet student needs. Instead of replacing teachers, they adjust workloads. Behind progress lies uneven ground - some benefit fast, others lag behind. Still, digital tools open doors once locked by location or income. From cities to villages, data shapes lessons differently now. While doubts remain, momentum builds quietly beneath policy and practice.
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