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IMPROVING CHEMISTRY TEACHING METHODS IN AN E-LEARNING ENVIRONMENT

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Abstract. This article looks at ways to make chemistry teaching better in e-learning setups. It focuses on adding interactive digital tools, virtual lab platforms, and strategies centered on students. Drawing from my own teaching background and some careful analysis, I dig into how online chemistry lessons turn more effective, reachable, and full of real concepts when we use tech-boosted teaching methods. Well-put-together e-learning systems help build up students' reasoning in science. They boost involvement too. Plus, they offer learning chances that are flexible in ways old-school classrooms often cannot match. The piece points out fresh models for teaching chemistry online. It also suggests real fixes for typical teaching hurdles in virtual spaces.

Keywords. Digital pedagogy, virtual laboratories, interactive learning, student engagement, online assessment, blended learning.

Introduction.

These days, the education field in our Republic gets plenty of support and chances. The President of Uzbekistan, Sh.M. Mirziyoyev, named 2023 the Year of Attention to Humanity and Quality Education. That move really shows the strong focus on making education top-notch. One big goal for the government this year involves lifting education quality in schools. It also means raising the status of teaching jobs in society. And it includes bettering the working conditions for educators.

Teachers carry a heavy load when it comes to education quality. The teaching process covers guided classroom sessions with a teacher. It also includes solo efforts to pick up key knowledge. Usually, that independent work sticks to rote memorization of theory. Still, theory works best when it feels visual, engaging, and easy to grasp. Studying descriptions of objects, events, and processes hits home more with interactive methods. Those let you not just read the stuff. You get to watch processes unfold visually. You can examine them closely. And you see things that stay hidden in real life.

As I got deeper into e-learning, it hit me that online chemistry teaching demands more than just shifting regular lessons to screens. I had to rethink framing chemical ideas, tests, and problem-solving for virtual spaces. That insight drove me to check out fresh teaching ways. They needed to keep chemistry's hands-on and deep side alive, even without a real room full of gear. In my digging, I tried figuring out how digital aids, multimedia bits, and interactive sims could help students build science know-how on their own.

Once I rolled out online modules, students' reactions to digital stuff stood out from in-person classes. Lots of them leaned on visual hints, clickable diagrams, and repeated step-by-step guides.

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That pushed me to try out stronger multimedia tricks for tough chemical steps. From what I saw, online setups let you show molecular builds, reaction paths, and lab steps in clear ways that old tools struggle with.

Looking closer at how chemical learning builds, I saw e-learning success ties to solid resources. But it also depends on guiding students through them right. So I worked on flexible paths that fit each learner's speed. I found those personal touches lift motivation a lot. They help especially for students who falter in standard classes.

In this study, I checked how live and on-demand tools work together. Real-time chats clear up idea confusions for students. Meanwhile, self-paced parts let them revisit hard topics freely. Mixing them made online chemistry stronger and open to more people.

With digital shifts speeding up, I hunted for ways to hold onto chemistry's lab spirit. Virtual labs, sim-based tests, and digital models for reactions turned key in my approach. Bringing them in let me mimic the probing side of chemical work. Students could try things safely, over and over.

From my classroom time, online spots sparked teamwork in fresh forms. Kids shy in real rooms spoke up more in forums and chats. That change showed how e-learning levels the playing field. It ramps up science talks too.

My ongoing thoughts made clear that better chemistry teaching online calls for full changes in teaching mindsets. Think reassessing tests, talks, interactions, and support structures for ideas. This article pulls together what I found. It lays out steps for deep, real, student-focused chemistry learning in digital form. I think these ideas can aid teachers, researchers, and others in stepping up digital chemistry teaching. They can meet the changing demands of today's students well.

Main part.

The President's Resolution from November 26, 2019, PQ-4537, covers steps to set up Modern Schools in Uzbekistan. It stresses supplying secondary schools with current learning aids. Those include electronic books, visual labs, interactive boards, and multimedia gear. Around the world, folks run practical tests on remote classes at every education level. Developed nations like the USA, Germany, Britain, Japan, and South Korea built distance learning early. They shifted to it smoothly. Other places faced real snags in moving to remote education.

When I started looking at how e-learning might work for teaching, I noticed that digital setups give teachers fresh chances to change up their chemistry classes in ways that were not possible before. These platforms make it easy to add simulations, visual representations, and hands-on exercises straight into the lessons, so students can grab both practical skills and core ideas right away.

I saw that kids pick up chemical ideas better when they get to tweak things in online simulations. They change things like concentrations, heat levels, or how molecules are built, and they watch the results happen live, which helps them really get the concepts. The way e-learning bends to fit different needs let me build lessons that matched each student's level. Those who needed extra

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help could go back over the material, and the ones ahead could dive into tougher subjects. All this flexibility boosted how well everyone did and made them feel more sure of themselves.

With forums for talking and group work tools online, I picked up on how students jumped in more and gave smarter answers since they had time to think things through first. That led to better thinking skills and ways to talk about science. The quizzes online also let me track progress closer. Systems that give instant feedback helped students spot errors and fix them on the spot, which improved their skills with chemical math.

Adding in things like moving pictures, clickable drawings, and sound explanations made tough topics easier to grasp, especially stuff like heat flow, reaction speeds, and shapes of molecules. In the end, e-learning shifts how students experience chemistry by making it more about seeing things, adjusting to needs, and focusing on the learner, way beyond what old-school methods can do.

Methods.

For this work, I took a hands-on path by building and using different online modules in my chemistry classes. I kept an eye on how students used the digital parts and what that did to their grasp of ideas.

I did some thinking about my teaching too, checking it against how students did, data on their involvement, and what they said in surveys. That helped me tweak the course setup over time. I compared old ways of teaching with online ones to spot the differences. Looking at how students performed in each setup gave me clues about what really helped learning stick.

Electronic textbooks come with several strong points. They offer flexible timing for lessons and easy access whenever needed. Students can follow a personal schedule that fits their own pace and abilities. The way they check knowledge stays fair and does not depend on the teacher alone. There is room to talk with instructors right during the study time. They include bright images, moving animations, sounds, linked text, and active web parts like quizzes or practice books and charts. Updates happen easily if changes are required. Costs for making and sharing them stay low. Plus, they link to extra books, digital collections, learning websites, and other helpful spots.

I used ways to watch closely by studying patterns in how students joined virtual chats, tried online labs, and worked together. Those looks showed how online spaces shift the flow of learning. A method that mixes tech with teaching guided what I did, making sure the digital bits lined up with what students needed to learn. That kept every tool tied to a real teaching goal.

I also looked at data from tests, lab write-ups, and logs of online actions. The real proof from that let me gauge how much e-learning tools affected teaching. By testing changes to the modules, I figured out which setups, tools, and plans worked best to help students understand chemistry online.

Results and Discussion.

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What came out of this work shows that online learning spaces boost how involved students get and how well they master chemistry ideas. Those who used digital simulations did stronger on tasks about reaction paths and reading molecular builds compared to ones just using books.

Fake labs turned out great for building skills in experiments. Students ran steps over and over, checked data on screens, and fixed errors without any dangers, which built their trust in doing labs. I saw that mixing in multimedia helped them remember better. They held onto visual steps more than plain word explanations, especially for things like electric chemistry and reactions in organics.

The work also pointed out that tools for group work online raised how much students joined in and led to richer talks about science. They posed more queries, replied to others, and linked ideas tighter. Data from checks showed better rightness in chemical math for students using online solvers with quick feedback. Their mistakes dropped a lot. Models that blend self-paced stuff with live classes worked best overall. That mix gave room to adjust while keeping spots for instant help and clear-ups. These outcomes back up that well-planned digital setups lift the level and strength of chemistry teaching.

Conclusion.

To wrap it up, what I found points to needing smart mixes of high-tech tools, fresh lesson plans, and ongoing checks on teaching to better chemistry in online spaces. The work spotlights issues like not everyone having tech access, some teachers lacking digital know-how, and trouble matching hands-on lab feels. Still, training for teachers, better tech setups, and solid virtual labs can handle those. What makes this piece matter is its push on updating chemistry teaching amid worldwide digital shifts. The ideas here offer real fixes and show how e-learning builds science skills, deepens idea grasps, and gives bendy learning paths. I think this adds real value to pushing chemistry teaching worldwide and guides teachers set on better online methods.

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