CALIFORNIA CURRICULUM COLLABORATIVE

DIGITAL PRODUCT FEATURE GUIDANCE

Teacher-facing Digital Product Features

Digital Product Feature Category:	Feature:	Look for:	Exemplary products might:	Strength of evidence:	Questions for publishers: "Show me/tell me..."	My Notes:
Automation	**Automated grading**	• The option to auto-grade assignments and/or assessments.	• Leverage AI to grade and/or provide feedback on handwritten work (e.g., photos of written work, work completed on a digital scratchpad/whiteboard). • Seamlessly integrate autograding with your LMS.	**Moderate evidence** of improving student learning	*What types of practice problems is auto-grading available for?* *Can you walk me through how grading data feeds into a teacher's gradebook or LMS? What does that process look like?*	
	Group creation tool	• Tools that allow teachers to create small groups of students for group work or assignments.	• Provide suggestions for student grouping based on student data. • Automatically create heterogeneous or homogenous groups based on teacher input.	**Emerging evidence** of improving student learning	*What features does the product have to enable student group work? Can you show me an example?* *Does the product suggests student groups? What information or data drives the suggestions, and does it show the rationale so that teachers can understand and trust the suggestions?*	
	Item bank and templates	• The option to automatically generate assessment items based on criteria such as learning objectives and student performance. • The ability to select questions and question types.	• Provide options for personalization of questions (e.g., based on student interests).	Limited/no existing evidence base	*What kinds of tools does the product have to help build and customize assessments?*	
	Report generation	• The ability to auto-generate reports summarizing student performance, progress towards learning objectives, and comparison with benchmarks.	• Provide actionable insights for teachers. • Provide functionality to easily share reports with stakeholders, such as parents. • Provide administrator access to reports.	**Emerging evidence** of improving student learning	*What kinds of information can the product summarize about student performance or progress toward learning goals? Can you show me an example of a report?* *What options exist to access, automate, or customize reports for different audiences, such as teachers, caregivers, or administrators?*	

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DIGITAL PRODUCT FEATURE GUIDANCE

Teacher-facing Digital Product Features (Cont.)

Digital Product Feature Category:	Feature:	Look for:	Exemplary products might:	Strength of evidence:	Questions for publishers: "Show me/tell me..."	My Notes:
Customization	**Customizable presentations**	• Pre-made and customizable presentation templates to support teachers in their classroom instruction.	• Allow for customization / editing within slides, as opposed to the ability to re-order presentation content.	Limited/no existing evidence base	*What features or templates exist to support teachers in creating custom presentation slides for classroom instruction, and how much flexibility do teachers have in editing the content?*	
	Creation and curation of practice materials	• The ability to generate and preview practice modules based on criteria such as grade level, topics, and standards. • The ability to customize content as needed, such as which questions are included and the question formats.	• Provide adaptive student supports (suggestions, feedback, etc.) while students are engaging with independent practice/homework content.	Limited/no existing evidence base	*What tools or features does the product include to build practice modules around a specific topic or standard? How much control do teachers have over editing or selecting the types of questions included in a practice module?*	
	Lesson plan customization	• Customizable lesson plan templates.	• Provide opportunities / suggestions to customize lesson plans based on student data.	**Emerging evidence** of improving student learning and engagement	*What kinds of lesson plan templates are available in your product, and how can teachers adapt and customize them for their classrooms?* *What supports or suggestions are provided to customize lesson plans based on student data?*	
	Personalization of lesson content	• Tools to increase personalization of content based on student interests, local context, etc..	• Leverage AI to automate customization. • Provide a large number of personalization options (e.g., through use of AI) to meet a wide variety of student interests, as opposed to a handful of select options.	**Strong & consistent evidence** of improving student learning and engagement	*How does your product support teachers in tailoring lesson content to reflect students' identities, backgrounds, or interests?* *What examples can you share of how teachers have used your product to make lessons more engaging or relevant for different students?*	

CALIFORNIA CURRICULUM COLLABORATIVE

DIGITAL PRODUCT FEATURE GUIDANCE

Teacher-facing Digital Product Features (Cont.)

Digital Product Feature Category:	Feature:	Look for:	Exemplary products might:	Strength of evidence:	Questions for publishers: "Show me/tell me..."	My Notes:
Ease of use	**Product usage guidance**	• Guidance on using the product, such as through FAQs, tutorials, or helpful pop-ups when users log in for the first time.	• Feature in-product tutorials/tooltips or pop-ups for new or complex features. • Include a searchable support library. • Enable quick onboarding to basic functionality.	Limited/no existing evidence base	*When a teacher first logs into your platform, what is the onboarding experience like? What types of guidance or orientation is provided to help teachers become familiar with the basic functionality of the product, as well as on new or complex features?* *What kinds of supports or resources are embedded in the product if a teacher wants to look up how to use a given feature?*	
	Searchability & intuitive navigation	• The ability to search for the content teachers looking for within the digital product. • Clutter-free, clean, and straightforward user interfaces. • Clear labels, concise usage instructions, intuitive icons. • Consistent use of icons and labels across the platform to maintain simplicity for the user.	• Provide "breadcrumb" trails for easy navigation to orient users. • Offer filtering and predictive search across content. • Prioritize frequently used features, hide distractions, or de-emphasize rarely used features. • Offer dashboard customization.	Limited/no existing evidence base	*How do teachers find specific content within your product, and what tools are available to make that search straightforward?* *Show me how I could search for _____.* *How has teacher feedback informed your user experience and interface?*	
	Technical support	• Availability of technical support, preferably live, for both students and teachers.	• Offer multiple support modalities (live chat or ticket systems) that are easy to find. • Provide searchable and clearly labeled help sections.	Limited/no existing evidence base	*If a teacher or student encounters a technical issue during class, what support options are available to them in the moment?* *What kinds of support channels (chat, email, phone, etc.) do you offer, and how prompt are responses?*	

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DIGITAL PRODUCT FEATURE GUIDANCE

Teacher-facing Digital Product Features (Cont.)

Digital Product Feature Category:	Feature:	Look for:	Exemplary products might:	Strength of evidence:	Questions for publishers: "Show me/tell me..."	My Notes:
Professional learning	**Resources on content, pedagogy, enactment**	• Access to a wide variety of professional learning resources to support teachers with content, pedagogical best practices, and how to enact them.	• Provide professional learning resources through a variety of medium options beyond articles, such as videos. • Support communication between teachers who are using the product to engage with one another regarding questions and best practices.	**Strong & consistent evidence** of improving student learning and **emerging evidence** of improving student engagement	*What supports are included to help teachers:* *1) understand the instructional approach of the program?* *2) plan for instruction effectively?* *3) implement the program with integrity?*	
	Personalized professional development	• Personalization of professional learning content based on teachers' interests, needs, or what is most relevant to their class.	• Automate feedback to teachers through the use of AI (e.g., suggesting asset-based language, uptake of student contributions, talk time, questioning practices).	**Strong & consistent evidence** of improving student learning and **emerging evidence** of improving student engagement	*Does your product personalize teacher professional development based on things like teacher needs or what is most relevant to their class?*	
Student insights	**Diagnostic assessments**	• Adaptive assessments that can be used to determine the student's understanding of prior content and grade-level content. • Assessments that personalize the student pathway or create small groups for instruction based on performance.	• Include an analytics dashboard that enables interpretation of results by student group or other filters.	**Moderate evidence** of improving student learning and **strong & consistent evidence** of improving student engagement	*How do the program's assessments support teachers in understanding their students learning needs?* *How does the product support teachers in responding to a range of learning needs the assessment data may reveal?*	
	Differentiation & intervention supports	• Options for supporting students who are struggling with a concept or lesson or could benefit from enrichment. Options should extend beyond re-assigning the same lesson or problems to the student.	• Identify the specific skills or misconceptions a student or group of students is struggling with. • Tailor, or allow the teacher to tailor, interventions to specific skills or areas of misconception. • Suggest specific actions for teachers to take (e.g., whole-class re-teach of a concept, small group support, individualized student support).	**Strong & consistent evidence** of improving student learning and **emerging evidence** of improving student engagement	*How does your platform help teachers recognize and address specific skills or misconceptions students are struggling with? What kinds of intervention options are available beyond just repeating the same assignment or lesson?* *How does the product help teachers make decisions like when to re-teach a concept to the whole class, form small groups, or provide individual support?*	

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DIGITAL PRODUCT FEATURE GUIDANCE

Teacher-facing Digital Product Features (Cont.)

Digital Product Feature Category:	Feature:	Look for:	Exemplary products might:	Strength of evidence:	Questions for publishers: "Show me/tell me..."	My Notes:
Student insights	**Messaging system**	• A messaging system that enables communication between students, teachers, and/or caregivers.-	• Send automated, personalized, and differentiated messaging based on the student's development and progress.	**Moderate evidence** of improving student learning and **strong & consistent evidence** of improving student engagement	*What communication tools are built into your platform to support interaction between teachers, students, and caregivers?*	
	Performance data	• Student performance and participation tracking, such as pinpointing how students are performing on specific concepts or topics. • Availability of aggregate class data in addition to individual student data. • Data visualizations that support teacher insights and understanding.	• Ensure performance data is closely tied to instruction by providing suggestions, hints or ongoing coaching for teachers to support students in line with the data.	**Moderate evidence** of improving student learning and student engagement	*What types of performance data does your product capture, and how detailed is it when breaking down specific concepts or skills? In what ways can the data be aggregated?* *How are teachers supported in making sense of the data? In what ways does the product use performance data to provide instructional guidance or coaching on next steps for teachers?*	
	Real-time monitoring	• Real-time monitoring features that empower teachers to track student progress, identify areas of difficulty, and provide timely intervention.	• Alert the teacher when a student is "stuck". • "Nudge" students, teachers, or caregivers can based on selected criteria, such as students' unfinished assignments or repeated struggle with concepts.	**Strong & consistent evidence** of improving student learning and **emerging evidence** of improving student engagement	*What kinds of alerts or notifications help flag when a student is struggling, stuck, or falling behind?* *How does the product signal or nudge students, teachers, and caregivers to take action based on patterns like incomplete assignments or repeated errors?*	
	Usage and engagement data	• The ability to track student attendance and participation to measure usage and engagement.	• Allow teachers to view what students see/experience at any time with a button to quickly switch between available roles (e.g. teacher and student).	**Emerging evidence** of improving student learning and **moderate evidence** of improving student engagement	*What aspects of student participation or engagement does your product track, and how are those insights shared with teachers?*	

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DIGITAL PRODUCT FEATURE GUIDANCE

Student-facing Digital Product Features

Digital Product Feature Category:	Feature:	Look for:	Exemplary products might:	Strength of evidence:	Questions for publishers: "Please show me/tell me..."	My Notes:
Differentiation	**Adaptive assessments**	• Assessments that adapt to student performance in real-time, adjusting question difficulty based on responses. • Assessments that inform the student's personalized pathway in digital lessons and provide valuable data for teachers to use in their teaching.	• Provide feedback to students quickly or immediately • Provide feedback that goes beyond correct/incorrect.	**Emerging evidence** of improving student engagement	*What kinds of feedback do students receive during or after assessments, and in what ways are assessments connected to a student's personalized learning pathway?*	
	Adaptive learning pathways	• Learning sequences that adapt to the student's progress and performance by adjusting the questions and exercises to the individual student.	• Identify when a student is "stuck" and alert the teacher. • Adapt based on individual problem solving strategies, not just right/wrong answers.	**Moderate evidence** of improving student learning and **strong & consistent evidence** of improving student engagement	*How does your product address the learning needs of students who have gaps in prerequisite content so that they can be successful with grade-level content?*	
	Adaptive supports	• Products that provide tailored feedback and hints as students engage with the concepts. • Products that offer positive reinforcement when users succeed and provide targeted assistance during challenging moments.	• Identify specific misconceptions/errors and provide supports targeted to address that particular misconception. • Provide multiple options for students to receive additional support, such as through getting a "hint", watching videos, chatting with an AI-tutor, asking a peer for help, etc.	**Moderate evidence** of improving student learning and **emerging evidence** of improving student engagement	*What options do students have for support within the product if they are struggling with a problem or concept? Can you show me what this looks like in the product?* *How does your product tailor student supports based on their particular misconception or learning journey?*	
	Formative assessment	• Products that gauge knowledge and understanding of instructional materials, such as questions after teaching a concept, checks for understanding, or exit tickets.	• Provide clear and explicit alignment between learning objectives and assessments.	**Strong & consistent evidence** of improving student learning and engagement	*What opportunities are built into your materials for teachers to quickly check students' understanding of new concepts?*	

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DIGITAL PRODUCT FEATURE GUIDANCE

Student-facing Digital Product Features (Cont.)

Digital Product Feature Category:	Feature:	Look for:	Exemplary products might:	Strength of evidence:	Questions for publishers: "Please show me/tell me..."	My Notes:
Ease of use	**Interactive AI tutor**	• AI-powered tutoring systems that may simulate one-on-one interaction and provide personalized guidance and support. • Opportunities for two-way interaction, such as through a chat feature.	• Promote motivation, engagement, and persistence by engaging in sentiment analysis to understand when a student is frustrated or confused and adapting accordingly (e.g., providing motivational feedback, suggesting a break, providing resources to support understanding, etc.)	**Strong & consistent evidence** of improving student learning and **moderate evidence** of improving student engagement	*How does the AI tutor engage with students in two-way interactions rather than just giving answers?* *What mechanisms are in place for the AI tutor to detect when a student is frustrated, confused, or disengaged, and how does it respond? In what ways does the AI tutor provide motivational support or encouragement to help students persist with difficult tasks?* *What safeguards are built in to ensure conversations with the AI tutor remain safe and productive for the student?*	
	Simple, intuitive navigation	• The ability to search for the content teachers looking for within the digital product. • Clutter-free, clean, and straightforward user interfaces. • Age-appropriate labels, usage instructions, and icons. • Consistent use of icons and labels across the platform to maintain simplicity for the user.	• Provide “breadcrumb” trails for easy navigation to orient users. • Minimize extraneous content that detract from instructional material, such as "decorative" images or design features. • Prioritize frequently used features, hide distractions or de-emphasize rarely used features.	**Emerging evidence** of improving student learning and **moderate evidence** of improving student engagement	*How are students supported in navigating the product interface? Do these supports vary for different age groups?* *How did/does student feedback inform the product design?*	

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DIGITAL PRODUCT FEATURE GUIDANCE

Student-facing Digital Product Features (Cont.)

Digital Product Feature Category:	Feature:	Look for:	Exemplary products might:	Strength of evidence:	Questions for publishers: "Please show me/tell me..."	My Notes:
Ease of use	**Authentic & relevant examples**	• Authentic, real-world problems that require students to develop related solutions.	• Allow students to choose context of problem to represent topics that matter to/interest them. • Make explicit connections between content and real-world scenarios or careers where this learning is applied.	**Emerging evidence** of improving student learning and engagement	*In what ways can students choose or shape the context of problems to make them more meaningful or relevant?* *Can you share an example of how your product encourages students to apply what they're learning to authentic challenges?* *How does your product connect lesson content to real-world scenarios or careers students might care about?*	
	Gamification (badges, points, ...)	• Game-like elements such as points, badges, or levels to enhance engagement and motivation for students.	• Allow students to leverage choice and voice, for example, by selecting: their own level of challenge, the type of reward or recognition, avatars, etc. • Enable social learning opportunities, such as the ability to compete with/work together with other students (e.g. leaderboards, team challenges, request help from another student, etc.).	**Emerging evidence** of improving student learning and **moderate evidence** of improving student engagement	*What kinds of game-like elements are built into your platform, and how do they support student motivation? How much choice do students have in setting their own challenges, rewards, or recognition within the system?* *In what ways does gamification encourage social learning, such as teamwork, friendly competition, or peer support?*	
Engagement	**Game-based learning and assessment**	• Interactive educational games that happen in or outside of lessons to extend practice on concepts and skills. These games can be used to assess, as opportunities for application or deliberative practice, or as a "brain break" to re-engage students.	• Go beyond "brain breaks" by leveraging games as a means to enhance conceptual understanding. • Situate game-based learning into authentic or real-world contexts.	**Moderate evidence** of improving student learning and **strong & consistent evidence** of improving student engagement	*What role do interactive games play in your product? Are they primarily for review, practice, assessment, or deeper conceptual learning?*	

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DIGITAL PRODUCT FEATURE GUIDANCE

Student-facing Digital Product Features (Cont.)

Digital Product Feature Category:	Feature:	Look for:	Exemplary products might:	Strength of evidence:	Questions for publishers: "Please show me/tell me..."	My Notes:
Engagement	**Interactive manipulatives**	• Interactive manipulatives, such as simulations or interactive exercises that are seamlessly integrated into digital lessons to promote hands-on learning experiences and application of concepts.	• Provide the option to use interactive manipulatives and tools across on all appropriate practice problems, not just specific problems.	**Strong & consistent evidence** of improving student learning and **moderate evidence** of improving student engagement	*What kinds of interactive tools or manipulatives are available in your materials, and how are they integrated into lessons? In what ways can teachers choose apply manipulatives across different problems or activities? Can you show me an example of the types of interactive manipulatives available?* *How do students use manipulatives to explore or test out concepts during practice in hands-on ways?*	
	Multimedia	• Multimedia elements such as images and videos that align with the lesson objectives. • Multimedia that does not distract from key learning takeaways does not overwhelm the learners.	• Reinforce the key information of the lesson in a way that is suitable for the student audience. • Use visual elements to complement text or narration to convey deeper or better understandings of topics, but narrated videos do not simply restate on-page text (screen reader technology excluded).	**Moderate evidence** of improving student learning and engagement	*What types of multimedia (videos, animations, images) are incorporated, and how do they support lesson objectives?* *How do you ensure that multimedia clarifies or deepens understanding rather than overwhelming or distracting students?*	

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DIGITAL PRODUCT FEATURE GUIDANCE

Student-facing Digital Product Features (Cont.)

Digital Product Feature Category:	Feature:	Look for:	Exemplary products might:	Strength of evidence:	Questions for publishers: "Please show me/tell me..."	My Notes:
Engagement	**Peer-to-peer interaction**	• Discussion forums, tech-enabled group work, and other options for engagement with peers that allow students to interact with each other to discuss topics and concepts. • Ability for teachers to monitor peer-to-peer engagement to assess understanding. • Opportunities for the teacher to digitally share student work to facilitate class discussion.	• Support immediate (real-time) collaboration for online group work.	**Emerging evidence** of improving student learning and **moderate evidence** of improving student engagement	*How does the product support real-time student interaction for online group work or collaborative problem-solving?* *Can you show me an example of how students could collaborate live on a task? What features allow the teacher to monitor, guide, or share student contributions to enrich class discussion? What logs or analytics exist for peer-to-peer engagement?*	
	Student reflection tools	• Opportunities for students to reflect on their learning and goals to support metacognition and engagement.	• Have a built-in note-taking mechanism that can be accessed at any time and exported.. • Encourage students to make connections between new knowledge and what they already knew or believed. • Provide activities that require students to regularly explore conclusions and/or implications of new knowledge learned.	**Moderate evidence** of improving student learning and engagement	*How does the platform encourage students to connect new ideas with what they already know or believe?* *How can teachers access or use student reflections to support metacognition and goal-setting?*	

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Appendix

Evidence Base Rating Key	
1 **Strong & Consistent Evidence**	• Multiple high-quality studies (RCTs, well-designed quasi-experiments, or a mix) consistently demonstrate effectiveness. • Effect sizes suggest practical impact beyond just statistical significance and no negative findings. • Evidence comes from relevant contexts (e.g., similar populations, settings and implementation conditions Gates targets, such as priority students, Title I schools in the US). • Findings are replicated across different research teams or periods.
2 **Moderate Evidence**	• At least one rigorous study (RCT, quasi-experiment) or in exception cases a mix of correlational studies shows effectiveness, but replication is limited. • Study designs control for key confounding factors but may have some limitations. • Some mixed findings exist, but the weight of the evidence leans positive. • The evidence comes from a slightly different context Gates is interested in but still relevant context.
3 **Emerging Evidence**	• Early-stage research (correlational studies, case studies, or expert consensus) suggests potential effectiveness. • No rigorous impact studies yet, but a strong theoretical or logic model supports the approach. • Findings are promising in specific contexts but inconsistent or lack practical impact, requiring further validation across different settings. • Studies have methodological weaknesses and limitations
4 **Limited/No Evidence**	• No empirical research exists to support the effectiveness of the product feature to draw conclusions. • Only anecdotal or marketing claims are available.

Note: No evidence does not mean the product feature is not effective at improving student learning or student engagement. The research base has yet to be established or is highly limited at this time. There are no product features included in this guidance that have been found through a rigorous evidence base to be ineffective or counterproductive to student learning or engagement.

Key Sources

Teacher-facing Digital Product Features

Digital Product Feature Category:	Feature:	Strength of evidence:	Key sources:
Automation	**Automated grading**	**Moderate evidence** of improving student learning	Feng et al (2024) Supporting Middle School Math Learning With a Technology-Based Intervention: Impact, Moderators, and Usage Huang et al (2024) Exploring the Long-Term Effects of the Statewide Implementation of an Automated Writing Evaluation System on Students' State Test ELA Performance
	Group creation tool	**Emerging evidence** of improving student learning	Chen & Kuo (2019) An optimized group formation scheme to promote collaborative problem-based learning Liang et al. (2022) Algorithmic group formation and group work evaluation in a learning analytics-enhanced environment: implementation study in a Japanese junior high school
	Item bank and templates	Limited/no existing evidence base	McMahon et al. (2024) The Future of Math Inclusion: The Promise of Digital Math Tools for Universally Accessible Mathematics Instruction
	Report generation	**Emerging evidence** of improving student learning	Rundquist et al. (2024) Use of Learning Analytics in K–12 Mathematics Education:Systematic Scoping Review of the Impact on Teaching and Learning Gross et al. (2024) How do Expert and Novice Teachers Monitor and Enhance Student Understanding? Qualitative Comparisons Informing the Design of a Digital Formative Assessment Platform Viberg et al. (2020) Self-regulated learning and learning analytics in online learning environments: a review of empirical research
Customization	**Customizable presentations**	Limited/no existing evidence base	Hillman & Zamani (2019) Designing Mobile Presentation Apps for North American K-12 Teachers
	Creation and curation of practice materials	Limited/no existing evidence base	Davis et al. (2020) Homework Helper: Providing Valuable Feedback on Math Mistakes

Key Sources (Cont.)

Teacher-facing Digital Product Features

Digital Product Feature Category:	Feature:	Strength of evidence:	Key sources:
Customization	**Lesson plan customization**	**Emerging evidence** of improving student learning and engagement	Karpouzis et al. (2024) Tailoring Education with GenAI: A New Horizon in Lesson Planning Zheng et al. (2024) Automatic Lesson Plan Generation via Large Language Models with Self-critique Prompting Tobias et al. (2016) To customize or not to customize? Exploring science teacher customization in an online lesson portal Matuk et al. (2015) Technology to support teachers using evidence from student work to customize technology-enhanced inquiry units
	Personalization of lesson content	**Strong & consistent evidence** of improving student learning and engagement	Walkington & Bernacki (2019) Personalizing Algebra to Students' Individual Interests in an Intelligent Tutoring System: Moderators of Impact Bernacki & Walkington (2018). The role of situational interest in personalized learning Høgheim & Reber (2015) Supporting interest of middle school students in mathematics through context personalization and example choice Renninger & Hidi (2016) The power of interest for motivation and engagement
Ease of use	**Product usage guidance**	Limited/no existing evidence base	ISTE (2024) Teacher Ready Edtech Product Evaluation Guide Roscoe et al. (2018) Human systems engineering and educational technology Okumuş et al. (2016) Utility and usability as factors influencing teacher decisions about software integration
	Searchability & intuitive navigation	Limited/no existing evidence base	ISTE (2024) Teacher Ready Edtech Product Evaluation Guide Roscoe et al. (2018) Human systems engineering and educational technology Okumuş et al. (2016) Utility and usability as factors influencing teacher decisions about software integration Adobe (2019) The 4 Golden Rules of UI Design
	Technical support	Limited/no existing evidence base	ISTE (2024) Teacher Ready Edtech Product Evaluation Guide Roscoe et al. (2018) Human systems engineering and educational technology Okumuş et al. (2016) Utility and usability as factors influencing teacher decisions about software integration

Key Sources (Cont.)

Teacher-facing Digital Product Features

Digital Product Feature Category:	Feature:	Strength of evidence:	Key sources:
Professional learning	**Resources on content, pedagogy, enactment**	**Strong & consistent evidence** of improving student learning and **emerging evidence** of improving student engagement	Mihaly et al. (2022) The Impact and Implementation of the Chicago Collaborative Teacher Professional Development Program. Schoen et al (2024) Effects of a Mathematics Teacher Professional Development Program on Grades 3-5 Student Achievement: A Multisite Cluster-Randomized Trial Nichol et al. (2018) Year-Long Teacher Professional Development on Fifth Grade Student Science Outcomes. Keller et al (2016) The impact of physics teachers' pedagogical content knowledge and motivation on students' achievement and interest Johnson et al (2014) A Study of the Impact of Transformative Professional Development on Hispanic Student Performance on State Mandated Assessments of Science in Elementary School
	Personalized professional development	**Strong & consistent evidence** of improving student learning and **emerging evidence** of improving student engagement	Copur-Gencturk et al (2024) The Impact of an Interactive, Personalized Computer-Based Teacher Professional Development Program on Student Performance: A Randomized Controlled Trial Clark et al (2022) Study of Teacher Coaching Based on Classroom Videos: Impacts on Student Achievement and Teachers' Practices. Darling-Hammond et al (2017) Effective Teacher Professional Development Demszky et al (2023) Can Automated Feedback Improve Teachers' Uptake of Student Ideas? Evidence From a Randomized Controlled Trial In a Large-Scale Online Course Demszky and Liu (2023) M-Powering Teachers: Natural Language Processing Powered Feedback Improves 1:1 Instruction and Student Outcomes Demszky et al (2023) Improving Teachers' Questioning Quality through Automated Feedback: A Mixed-Methods Randomized Controlled Trial in Brick-and-Mortar Classrooms
Student insights	**Diagnostic assessments**	**Moderate evidence** of improving student learning and **strong & consistent evidence** of improving student engagement	Swain et al. (2020). Impact Evaluation of Reading i-Ready Instruction for Elementary Grades using (2018–19) Data Alfageh et al (2024) Elementary teachers' use of adaptive diagnostic assessment to improve mathematics teaching and learning: A case study Coupland et al (2023) Does using diagnostic assessment to judge student confidence, supported by interactive software, empower students to demonstrate mastery of specific topics Pat-El et al (2024) Exploring the impact of student perceptions of Assessment for Learning on intrinsic motivation Hamza and Touhami (2024) Exploring the Effective Use of Diagnostic Tests in the High School English Classroom to Support Student Learning: An Action Research Study Ghazizadeh and Motallebzadeh (2017) The Impact of Diagnostic Formative Assessment on Listening Comprehension Ability and Self-Regulation

Key Sources (Cont.)

Teacher-facing Digital Product Features

Digital Product Feature Category:	Feature:	Strength of evidence:	Key sources:
Student insights	**Differentiation & intervention supports**	**Strong & consistent evidence** of improving student learning and **emerging evidence** of improving student engagement	Pane et al (2023) Students Using Lexia® Core5® Reading Show Greater Reading Gains Than Matched Comparison Students WestEd (2019) A Cross-State Evaluation of MIND Research Institute's ST Math Program and Math Performance Benavides-Varela et al (2020) Effectiveness of digital-based interventions for children with mathematical learning difficulties : A meta-analysis Van der Boom and Jang (2018) The Effects of Holistic Diagnostic Feedback Intervention on Improving Struggling Readers' Reading Skills Hill et al (2016) The Impact of Achieve3000 on Elementary Literacy Outcomes: Evidence from a TwoYear Randomized Control Trial Abbey Zens (2021)The Impact of Differentiated Learning Activities on Student Engagement and Motivation in the English Language Arts Classroom
	Messaging system	**Moderate evidence** of improving student learning and **strong & consistent evidence** of improving student engagement	Park et al (2022) Engaging Families Leads to Student Academic Gains and Increased Attendance: How TalkingPoints Improved Outcomes in a Large Urban School District AIR. 2020 Can Texting Parents Improve Attendance in Elementary School? A Test of an Adaptive Messaging Strategy Bergman and Chan (2019) Leveraging Parents through Low-Cost Technology: The Impact of High-Frequency Information on Student Achievement* Doss et al (2018) More than just a nudge: supporting kindergarten parents with differentiated and personalized text-messages Kraft and Rogers (2015) The underutilized potential of teacher-to-parent communication: Evidence from a field experiment
	Performance data	**Moderate evidence** of improving student learning and student engagement	Ansyari et al (2022) A systematic review and meta-analysis of data use professional development interventions Grabarek et al (2020) Does Teacher Data Use Lead to Improved Student Achievment? A review of the Empirical Evidence Supovitz et al (2018) Experimental Impacts of the Ongoing Assessment Project on Teachers and Students. Research Report Faria et al (2017) Getting students on track for graduation: Impacts of the Early Warning Intervention and Monitoring System after one year Wayman et al (2017) Longitudinal Effects of Teacher Use of a Computer Data System on Student Achievement West et al (2016) Achievement Network's Investing in Innovation Expansion: Impacts on Educator Practice and Student Achievement

Key Sources (Cont.)

Teacher-facing Digital Product Features

Digital Product Feature Category:	Feature:	Strength of evidence:	Key sources:
Student insights	**Real-time monitoring**	**Strong & consistent evidence** of improving student learning and **emerging evidence** of improving student engagement	Feng et al (2024) Supporting Middle School Math Learning With a Technology-Based Intervention: Impact, Moderators, and Usage Bond et al (2023) The current state of using learning analytics to measure and support K-12 student engagement: A scoping review Aslan et al (2019) Investigating the Impact of a Real-time, Multimodal Student Engagement Analytics Technology in Authentic Classrooms Holsterin et al (2018) Student Learning Benefits of a Mixed-Reality Teacher Awareness Tool in AI-Enhanced Classrooms Roschelle at al (2016) Online Mathematics Homework Increases Student Achievement
	Usage and engagement data	**Emerging evidence** of improving student learning and **moderate evidence** of improving student engagement	Demszky et al (2023) Student Engagement? Evidence from a Randomized Controlled Trial on a Math Tutoring Platform Kaliisa et al (2023) Have Learning Analytics Dashboards Lived Up to the Hype? A Systematic Review of Impact on Students' Achievement, Motivation, Participation, and Attitude

Student-facing Digital Product Features

Digital Product Feature Category:	Feature:	Strength of evidence:	Key sources:
Differentiation	**Adaptive assessments**	**Emerging evidence** of improving student engagement	Zhang et al (2024) Exploring the impact of the adaptive gamified assessment on learners in blended learning Ihichr et al (2024) A Systematic Review on Assessment in Adaptive Learning: Theories, Algorithms and Techniques
	Adaptive learning pathways	**Moderate evidence** of improving student learning and **strong & consistent evidence** of improving student engagement	Honke et al (2025) Adaptive learning in bionics: transforming science education Alrawashdeh et al (2024) Exploring the impact of personalized and adaptive learning technologies on reading literacy: A global meta-analysis Ahmed et al (2024) Comparative Analysis of Adaptive Learning and Fast for Word Programs for ASD Students in Learning English, and Mathematics, and Predicting Future Academic Performance Using Machine Learning Algorithms Matther E. Foster (2023) Evaluating the Impact of Supplemental Computer-Assisted Math Instruction in Elementary School: A Conceptual Replication Khazanchi et al (2023) Measuring Efficacy of ALEKS as a Supportive Instructional Tool in K-12 Mathematics Classroom with Underachieving Students Luo et al (2023) The Influence of AI-Powered Adaptive Learning Platforms on Student Performance in Chinese Classrooms Phillips et al (2020) Implementing an adaptive intelligent tutoring system Standen et al (2020) An evaluation of an adaptive learning system based on multimodal affect recognition for learners with intellectual disabilities Arroyo et al (2014) A Multimedia Adaptive Tutoring System for Mathematics that Addresses Cognition, Metacognition and Affect Walkington, C.A. (2013) Using adaptive learning technologies to personalize instruction to student interests: The impact of relevant contexts on performance and learning outcomes.
	Adaptive supports	**Moderate evidence** of improving student learning and **emerging evidence** of improving student engagement	Demedts et al. (2024) The effectiveness of explanatory adaptive feedback within a digital educational game to enhance fraction understanding Bimba et al. (2021) The Effects of Adaptive Feedback on Student's Learning Gains Iterbeke et al. (2021) The effects of computer-assisted adaptive instruction and elaborated feedback on learning outcomes. A randomized control trial Marwan et al. (2022) Adaptive Immediate Feedback for Block-Based Programming: Design and Evaluation Butterfuss et al. (2022) Strategy Uptake in Writing Pal: Adaptive Feedback and Instruction

Student-facing Digital Product Features (Cont.)

Digital Product Feature Category:	Feature:	Strength of evidence:	Key sources:
Differentiation	**Formative assessment**	**Strong & consistent evidence** of improving student learning and engagement	Qi et al (2024) Using meta-analytic path analysis to examine mechanisms relating students' perceived feedback, motivation, self-efficacy, and academic performance Aust et al (2023) Effects of formative assessment on intrinsic motivation in primary school mathematics instruction Yan et al (2022) The relationship between formative assessment and reading achievement: A multilevel analysis of students in 19 countries/regions Xuan et al (2022) The effectiveness of formative assessment for enhancing reading achievement in K-12 classrooms: A meta-analysis Pinar Karaman (2021) The Effect of Formative Assessment Practices on Student Learning: A MetaAnalysis Study Granberg et al (2021) A case study of a formative assessment practice and the effects on students' self-regulated learning Faber et al (2016) The effects of a digital formative assessment tool on mathematics achievement and student motivation: Results of a randomized experiment Lee et al. (2020) The Effectiveness and Features of Formative Assessment in US K-12 Education: A Systematic Review Rakoczy et al (2019) Formative assessment in mathematics: Mediated by feedback's perceived usefulness and students' self-efficacy Beau Simon (2019) The Effect of Formative Assessment on Student Motivation and Self-Regulation Hondrich et al (2018) Formative assessment and intrinsic motivation: The mediating role of perceived competence Hanover Research (2014) The Impact of Formative Assessment and Learning Intentions on Student Achievement Yin et al (2008) On the Impact of Formative Assessment on Student Motivation, Achievement, and Conceptual Change
Ease of use	**Interactive AI tutor**	**Strong & consistent evidence** of improving student learning and **moderate evidence** of improving student engagement	Thomas et al (2024) Improving Student Learning with Hybrid Human-AI Tutoring: A Three Study Quasi Experimental Investigation Stanford University Study (2024) How AI can improve tutor effectiveness Henkel et al (2024) Effective and Scalable Math Support: Experimental Evidence on the Impact of an AI- Math Tutor in Ghana Bastani et al (2024) Generative AI Can Harm learning Khritish Swargiary (2024) The Impact of AI-Driven Personalized Learning and Intelligent Tutoring Systems on Student Engagement and Academic Achievement: Ethical Implications and the Digital Divide Ilic et al (2024) The impact of intelligent tutoring systems and artificial intelligence on students' motivation and achievement in STEM education: A systematic review Rathika et al (2024) Developing an AI-Powered Interactive Virtual Tutor for Enhanced Learning Experiences Kumar et al (2023) Math Education with Large Language Models: Peril or Promise Kulik et al (2016) Effectiveness of Intelligent Tutoring Systems: A Meta-Analytic Review

Student-facing Digital Product Features (Cont.)

Digital Product Feature Category:	Feature:	Strength of evidence:	Key sources:
Ease of use	**Simple, intuitive navigation**	**Emerging evidence** of improving student learning and **moderate evidence** of improving student engagement	Hadjerrouit (2010) A conceptual framework for using and evaluating web-based learning resources in school education Park & Song (2015). Make e-learning effortless! Impact of a redesigned user interface on usability through the application of an affordance design approach Adobe (2019) The 4 Golden Rules of UI Design Leacock & Nesbit (2007) A framework for evaluating the quality of multimedia learning resources
	Authentic & relevant examples	**Emerging evidence** of improving student learning and engagement	CAST (2024) Universal Design for Learning Guidelines version 3.0. ISTE (2024) Teacher Ready Edtech Product Evaluation Guide Julia & Antoli (2018) Impact of implementing a long-term STEM-based active learning course on students' motivation
	Gamification (badges, points, ...)	**Emerging evidence** of improving student learning and **moderate evidence** of improving student engagement	Mohammed et al (2024) Effects of Gamification on Motivations of Elementary School Students: An Action Research Field Experiment Li et al (2024) Gamification enhances student intrinsic motivation, perceptions of autonomy and relatedness, but minimal impact on competency: a meta-analysis and systematic review Magallanes et al (2024) Enhancing Student Engagement through Gamification Strategies in Multi-Grade Classroom Grabner-Hagen and Kingsley (2023) From Badges to Boss Challenges: Gamification through Need-Supporting Scaffolded Design to Instruct and Motivate Elementary Learners Zeng et al (2023) Exploring the impact of gamification on students' academic performance: A comprehensive meta-analysis of studies from the year 2008 to 2023 Ratinho and Martins (2023) The role of gamified learning strategies in student's motivation in high school and higher education: A systematic review Huang et al (2020)The impact of gamification in educational settings on student learning outcomes: a meta-analysis Sailer and Homner (2020) The Gamification of Learning: a Meta-analysis Serdiouk et al. (2019) Improving Student Learning and Engagement through Gamified Instruction: Evaluation of iPersonalize

Student-facing Digital Product Features (Cont.)

Digital Product Feature Category:	Feature:	Strength of evidence:	Key sources:
Engagement	**Game-based learning and assessment**	**Moderate evidence** of improving student learning and **strong & consistent evidence** of improving student engagement	Manar Alotaibi (2024) Game-based learning in early childhood education: a systematic review and meta-analysis Al-Khayat et al (2023) The Effectiveness of Game-based Learning in Enhancing Students' Motivation and Cognitive Skills Barz et al (2023) The Effect of Digital Game-Based Learning Interventions on Cognitive, Metacognitive, and Affective-Motivational Learning Outcomes in School: A Meta-Analysis Alsadoon et al (2022) Effects of a gamified learning environment on students' achievement, motivations, and satisfaction Brezovszky et al (2019) Effects of a mathematics game-based learning environment on primary school students' adaptive number knowledge Partovi and Razavi (2019) The effect of game-based learning on academic achievement motivation of elementary school students Hussein et al (2019) Effects of Digital Game-Based Learning on Elementary Science Learning: A Systematic Review
	Interactive manipulatives	**Strong & consistent evidence** of improving student learning and **moderate evidence** of improving student engagement	Altiparmak and Ercan (2025) The Impact of Virtual Manipulatives in Online Learning on 4th Grade Students' Learning Paulov et al (2024) Comparing the impact of physical and virtual manipulatives in different science domains among preschoolers Farra et al (2024) Impact of using virtual and concrete manipulatives on students' learning of fractions Haley Gullion (2024) Virtual Versus Tangible Math Manipulatives: A Quasi-Experimental Study Comparing the Impact of Different Types on Mathematical Understanding Siller and Ahmad (2024) The Effect of Concrete and Virtual Manipulative Blended Instruction on Mathematical Achievement for Elementary School Students Ismail et al (2023) Learning through virtual manipulatives: Investigating the impact of Gizmos-based lessons on students' performance in integers Ukdem and Cetin (2022) Investigating the Impact of Interventions Using Concrete and Virtual Manipulatives on 3th Grade Students' Fraction Concept and Motivation Park et al (2022) Effects of Interventions Using Virtual Manipulatives for Students with Learning Disabilities:A Synthesis of Single-Case Research Lee et al (2014) The Impacts of Virtual Manipulatives and Prior Knowledge on Geometry Learning Performance in Junior High School Moyer-Packenham and Westenskow (2013) Effects of Virtual Manipulatives on Student Achievement and Mathematics Learning

Student-facing Digital Product Features (Cont.)

Digital Product Feature Category:	Feature:	Strength of evidence:	Key sources:
Engagement	**Multimedia**	**Moderate evidence** of improving student learning and engagement	Aulia et al (2024) The Role of Interactive Learning Media in Enhancing Student Engagement and Academic Achievement Putri and Alyani (2023) The Effect of Using Multimedia-Based Learning on Motivation and Learning Outcomes Rizk and Hiller (2022) Digital technology and increasing engagement among students with disabilities: Interaction rituals and digital capital Lauc et al (2020) Effects of Multimedia Instructional Message on Motivation and Academic Performance of Elementary School Students in Croatia
	Peer-to-peer interaction	**Emerging evidence** of improving student learning and **moderate evidence** of improving student engagement	Jarvenoja et al (2025) Investigating peer influence on collaborative group members' motivation through the lens of socially shared regulation of learning Kaya et al (2025) Peer Learning Effects on Students Outcomes: A Second Order Meta Analyses Fitri and Astuti (2024) The Power of Peers Unleashed in Motivating Elementary Learning Around the World Wu et al (2022) The role of perceived teacher and peer relationships in adolescent students' academic motivation and educational outcomes Borup, Walters & Call-Cummings (2020). Student perceptions of their interactions with peers at a cyber charter high school.
	Student reflection tools	**Moderate evidence** of improving student learning and engagement	Zhai wt al (2023) Can Reflective Interventions Improve Students' Academic Achievement: A Meta-analysis Chu et al (2023) A Goal-Oriented Reflection Strategy-Based Virtual Reality Approach to Promoting Students' Learning Achievement, Motivation and Reflective Thinking Sides and Cuevas (2020) Effect of Goal Setting for Motivation, Self-Efficacy, and Performance in Elementary Mathematics Derek Cavilla (2017) The Effects of Student Reflection on Academic Performance and Motivation Hematian et al (2016) On the Effect of Goal Setting on Self-Directed Learning, Achievement Motivation, and Academic Achievement among Students