

Intelligent Tutoring Systems

Category: Artificial Intelligence in Education

An intelligent tutoring system is an AI-enabled learning environment that provides individualised instruction or practice by modelling aspects of the subject, the learner and the tutoring process. It typically selects tasks, interprets responses and offers hints or feedback as interaction unfolds.

The word intelligent refers to adaptive computational behaviour, not human understanding. Such systems are often strongest in well-defined domains where knowledge and solution steps can be represented; their effectiveness varies with design, use and comparison conditions ([VanLehn, 2011](#)).

System Components

1. **Domain model:** Represents relevant concepts, procedures, solutions and common misconceptions.
2. **Learner model:** Updates an estimate of knowledge or difficulty from interaction data.
3. **Tutoring model:** Chooses a task, hint, explanation or feedback strategy.
4. **Interface:** Enables understandable, accessible interaction and displays learning activity.
5. **Human oversight:** Allows educators to inspect evidence, adjust use and support cases the model misses.

Examples in Practice

A mathematics tutor may trace each step in an equation, identify a likely misconception and offer a graduated hint. The student attempts the next step, while the lecturer uses the interaction record as one source of evidence rather than a complete account of understanding.

Why It Matters

Intelligent tutoring systems can provide extensive guided practice and immediate support. They do not reproduce the full relational, motivational and contextual work of a human tutor, and gains depend on curriculum alignment, usability and responsible integration with teaching. Educators should know which evidence drives the system and where its model of the subject is incomplete before relying on automated inferences ([Ma et al., 2014](#)).

Further Reading

6. VanLehn, K. (2011). [The relative effectiveness of human tutoring and tutoring systems](#). Educational Psychologist, 46, 197–221.
7. Ma, W., Adesope, O. O., Nesbit, J. C., & Liu, Q. (2014). [Intelligent tutoring systems and learning outcomes: A meta-analysis](#). Journal of Educational Psychology, 106, 901–918.
8. Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). [Systematic review of research on AI applications in higher education](#). International Journal of Educational Technology in Higher Education, 16, 39.

Related Terms: Adaptive Learning | Personalised Learning | Educational Chatbots | Learner Modelling