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Intelligence artificielle et apprentissage: Fondements, concepts et applications, by Sarah Chardonnens. De Boeck Supérieur, 2026. 336 pp., ISBN: 978-2-8073-7188-0.

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Book Review

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Sarah Chardonnens published *Intelligence artificielle et apprentissage: Fondements, concepts et applications* (Artificial Intelligence and Learning: Foundations, Concepts, and Applications) with De Boeck Supérieur in 2026. A doctor of educational sciences, she is a professor at the Haute École Pédagogique de Fribourg and the University of Fribourg in Switzerland and has focused on research and teacher training since 2019 (325). The book examines the effects of artificial intelligence on education. Its main purpose is to explain how AI can support learning without replacing the student's intellectual effort.

The book is not simply a guide to digital tools, nor does it present AI as a perfect solution to educational problems. Chardonnens promises "principles, not prescriptions," and warns that readers will not find "a catalog of applications, sorted by subject or by level," because such a catalog would soon be obsolete (18, 20; my trans.). She argues instead that AI should remain a learning aid and should not do the intellectual work for the student.

Chardonnens writes for secondary and higher-education teachers, adult trainers, and instructional designers, and she sends readers with management, coordination, IT, or legal responsibilities to chapter 11 on governance (19, 21). Its central question is how AI can be used without weakening the learner's abilities. In the author's words, the question is not "which tool to choose?" but "what do we want to teach, to whom, and at what cognitive and motivational cost?" (18; my trans.).

The question matters because AI produces answers very quickly. It can write a text, summarize a document, or explain a difficult concept. Speed, however, does not always lead to learning, and a student may obtain a correct answer without understanding it. Hence the book's refusal "to confuse production and learning, speed and understanding, assistance and autonomy" (18; my trans.).

Chardonnens adopts a balanced position. She neither recommends banning AI nor supports its unlimited use. For her, AI is "neither a condition nor a taboo" but "an environment variable" (227; my trans.). Its value depends on the way it is used and on the learning objective the teacher defines.

Human Intelligence and Artificial Intelligence

The first part of the book presents the main theoretical ideas, beginning with the distinction between human intelligence and artificial intelligence (51-70).

Human beings learn through experience by connecting new information to previous knowledge, and their emotions, memories, and relationships also shape that learning. Human

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learning is therefore a complex process that involves reasoning, feeling, remembering, and interacting with others.

Artificial intelligence works differently. It processes large amounts of data, identifies patterns, and produces results through statistical calculation. Such a system "learns" in the computational sense, by optimizing a mathematical function, but it "does not understand in the human sense: no intentions, no intrinsic meaning, no lived experience" (55; my trans.). It can generate a clear and convincing answer without understanding that answer as a human being would.

The distinction is essential, because a well-written answer can still be incorrect. Fluent language does not guarantee truth, so students must learn to check information, compare sources, and use their own judgment.

Two later chapters examine the processes involved in learning, namely attention, memory, motivation, emotions, and sleep, all of which affect the learner's progress (71-90, 123-32).

Learning is more than receiving information. Students must select and organize it, connect it to what they already know, and restate it in their own words. Finally, they must be able to use it in a new situation.

Effort plays an important role in this process. Mistakes are useful too, since they help students identify difficulties and correct their reasoning; error is a normal part of learning.

AI can sometimes reduce this necessary effort. When it immediately provides a complete answer, the student may skip important stages of reflection, which is why the author recommends using it carefully.

The SYNAPSE Model

The second part presents the SYNAPSE model, the book's main contribution. It organizes learning into four phases: "reception and activation," "adaptation and adjustment," "observation and self-regulation," and "consolidation and storage." The name stands for the English labels the book gives these phases: Sensory Input, Network Adaptation, Participation, and Storage & Embodiment (19).

Chardonnens built the model from a systematic literature review conducted to PRISMA standards, which narrowed 1,371 publications to 301 articles coded with MAXQDA, and from three exploratory qualitative studies carried out between 2023 and 2025 in a university, a secondary school, and an initial teacher-education program (147-49).

Motivation sits at the center of the model and influences every phase (141). It helps students begin a task and sustain their effort, and it also supports memorization.

The four phases are connected. Learners can return to an earlier stage, change their strategy, or reactivate previous knowledge, so learning appears as a dynamic process rather than a hierarchical sequence (139).

Reception and Activation

The first phase concerns the beginning of learning. Students must direct their attention toward the task and activate their previous knowledge, which makes new information easier to understand (151).

AI can support this phase in several ways. It can open a lesson with a question, or it can generate an image, a simulation, or a personalized example whose relevance the class then discusses (164-65). Such uses may stimulate curiosity.

The teacher, however, must keep a clear objective in view. An attractive activity is not always educational, and capturing attention is not enough. In the age of AI, Chardonnens writes, the

danger is not only distraction but an activation "by proxy," in which the machine captures attention and supplies answers before curiosity, questions, and hypotheses have emerged in the learner (166; my trans.).

Adaptation and Adjustment

The second phase concerns the transformation of knowledge, and the author calls it "the beating heart of the SYNAPSE model" (183; my trans.). Faced with a difficulty, the student searches for a solution, develops ideas, tests them, and sometimes makes mistakes that lead to a better understanding.

In this phase, error has a positive function. It shows what the student has understood and helps the teacher provide suitable support.

AI can adapt exercises to a learner's errors and offer counterexamples and explanatory feedback (173, 178-79). This assistance must remain limited, however, because help that comes too quickly can remove the effort that learning requires.

Her answer is a simple rule, an "imposed delay" before AI is used: students first sketch a solution on their own, then compare it with the AI's answer and discuss what the tool added, what they keep, and what they change (183; my trans.). This approach protects their intellectual activity and reduces their dependence on technology.

Observation and Self-Regulation

The third phase concerns the ability to observe one's own work. Learners must plan their actions, identify their mistakes, and evaluate their methods (187).

This ability, known as metacognition, allows students to understand how they learn. It also strengthens their independence and makes them more responsible for their progress.

AI can support this process by asking reflective questions, commenting on a method, or helping students monitor their progress.

The author recommends a sequence she sums up as "reflection first, comparison afterward": students reason on their own, then compare their approach with the one an AI proposes, and finally explain what they retain from the comparison (197-99; my trans.). AI must not become an unquestionable authority. The final judgment must remain human.

Consolidation and Storage

The final phase concerns long-term memory. New knowledge is fragile at first, so it must be reviewed several times and used in different situations (203-04).

The book emphasizes spaced repetition and active recall. Active recall requires learners to retrieve information without immediately consulting their notes, and this method strengthens memory.

Sleep also contributes to the consolidation of knowledge, and regular practice remains necessary. Learning therefore requires time and repeated effort.

Because AI can create quizzes, organize reminders, and provide varied exercises, it can become a useful revision tool. Chardonnens also reviews recent work on "cognitive offloading" and on what researchers at MIT have called "cognitive debt," and she concludes that AI can strengthen memory when it serves active retrieval but can weaken it when it entirely replaces the learner's own cognitive processes (207). The remedy is to keep learners active: they produce their own answers and explain ideas in their own words. Technology should strengthen mental activity, not replace it.

From Theory to Practice

The third part of the book is more practical. It shows how to plan teaching with SYNAPSE (235-52), what AI literacy, governance, and regulatory compliance require of teachers and institutions (253-62), how to educate critical citizens (263-70), how to put the model to work in class (271-88), and how to train teachers in a reasoned use of AI (289-302).

Several simple routines serve to develop critical thinking. One, "think first, compare afterward," asks students to produce something of their own before they look at an example, a model answer, or an AI output. Another, "Pause–Check–Decide," has them restate what the tool claims, verify at least one point, and then write in two lines whether they accept, reject, or qualify it, and why (273-75; my trans.).

Chapter 13 also supplies assessment rubrics and a short template for declaring the use of AI, to be attached to certain assignments, which allows students to explain how they used the technology (279-83). Such transparency encourages responsible use. Downloadable supplements on the publisher's website, among them SYNAPSE checklists and a "trust but verify" protocol, complement the text (8), and a glossary defines the main terms (313-24).

The examples cover mathematics, languages, science, arts and music, and physical education, along with an interdisciplinary project (283-88). This variety shows that the model can be adapted to different educational settings.

AI should not be added to a lesson without a clear purpose. Its use belongs in the lesson plan: only after making their pedagogical choices do teachers decide whether AI is forbidden, allowed, or required for a task, and on what conditions (272).

The Main Contributions of the Book

The book's first strength is its educational approach. According to the author, the originality of the model lies in a deliberate choice "to begin with the learner's internal trajectory, and not with technology" (19; my trans.), so education remains at the center of the discussion.

The model, as Chardonnens frames it, does not merely describe "what AI can do" but asks "what education must preserve" in the face of automation (139; my trans.). This change of perspective keeps teachers from following technological trends without reflection. The same feature, such as automated feedback, a dashboard, or a conversational agent, can strengthen or weaken learning depending on the phase in which it intervenes and on how it is built into the lesson (19).

The second strength is the SYNAPSE model, which brings together several dimensions of learning, including attention, motivation, memory, and metacognition. It gives teachers a clear framework for analyzing learning activities and identifying students' needs. Its value also extends beyond digital education, since the author offers it as a common language for analyzing a teaching sequence "with or without AI" (19; my trans.), whether a traditional lesson or a group project.

The third contribution concerns ethics, with discussions of bias in AI systems, data protection, transparency, and fairness (91-122, 253-62). Students do not all have equal access to digital tools or the same digital skills, and Chardonnens warns that AI designed without vigilance can widen the digital divide (103). Schools have to make sure that AI does not deepen existing inequalities.

Institutional responsibility receives similar attention. High-stakes decisions require human supervision (283), teachers remain responsible for pedagogical decisions and assessment, and AI "can never be the sole basis of an academic judgment" (258; my trans.).

Finally, the book practices what it recommends. In a Post Scriptum placed after the conclusion, Chardonnens names the AI tools she used while writing, among them Perplexity, SciSpace, and NotebookLM, and the purposes they served, from testing analogies and proposing counterexamples to summarizing articles. She adds that she accepted no reference without checking its authors, dates, and DOI (307).

Limitations

The empirical claims call for more caution than the introduction suggests. The introduction presents the book and the model as resting on "a solid empirical base" of field studies conducted "on various continents" (19; my trans.). Chapter 5, however, describes its three exploratory studies in a few paragraphs, without sample sizes and without naming the institutions or countries involved, and presents them as offering "first information for the empirical validation" of the model (148-49; my trans.). For now, SYNAPSE is best read as what its author calls "a heuristic and reflective tool" (137; my trans.) rather than as a validated model.

Chapter 11, whose title carries the year 2025, surveys the European AI Act and the GDPR, the Swiss, Canadian, British, and American frameworks, and international references from UNESCO and the OECD (253-62). The survey makes the chapter concrete, but it will date quickly, and it says nothing about African legal frameworks, so Moroccan readers, for instance, will have to transpose its guidance to their own data-protection rules.

Conclusion

Intelligence artificielle et apprentissage is a useful and well-documented book that offers a balanced reflection on artificial intelligence in education. Its main argument is convincing: AI does not automatically produce learning. Used well, AI should preserve the student's attention and effort, develop the ability to check information, and strengthen independence and critical thinking.

The book does not ask readers to choose between teachers and machines. It defines their different roles instead: AI may provide assistance, while teachers remain responsible for objectives, methods, and assessment.

Chardonnens's vision of education is human-centered: education does not stop at producing correct answers but teaches students to reason, verify information, defend ideas, and correct mistakes. The SYNAPSE model offers teachers a relevant method and can help students use AI responsibly, even if its empirical grounding still needs to be consolidated. The book's final message is clear: AI "does not replace education; it shifts what education must prioritize" (303; my trans.).

Work Cited

Chardonnens, Sarah. *Intelligence artificielle et apprentissage: Fondements, concepts et applications* [Artificial Intelligence and Learning: Foundations, Concepts, and Applications]. De Boeck Supérieur, 2026.