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AI in IS Education: A Categorization of ISCAP Publications Using Zuboff's Automate–Informate–Transformate Framework

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Abstract

The rapid emergence of generative artificial intelligence tools such as ChatGPT, Copilot, and Gemini has sparked widespread interest in their pedagogical applications within higher education. This study investigates how Artificial Intelligence is being applied in Information Systems education by analyzing ISCAP publications—including the Journal of Information Systems Education, the Information Systems Education Journal, and ISCAP conference proceedings from 2022 to 2025. Using Zuboff's automate–informate–transformate framework, the authors employed both Microsoft Copilot and human raters to categorize 18 peer-reviewed papers that explicitly address AI in teaching and learning contexts. The results reveal that most applications fall within the "informate" category, emphasizing AI's role in enhancing understanding, reflection, and skill development. Fewer papers were categorized as "automate," where AI replaces human tasks, or "transformate," where AI fundamentally restructures educational practices. Findings suggest that while automation is often used by instructors to streamline tasks, the dominant pedagogical value of AI lies in its capacity to inform and scaffold learning. Transformative uses of AI, though limited, are emerging and may signal future shifts in instructional design and learner engagement. This paper contributes to the growing discourse on AI in education by providing a structured lens for evaluating its impact and providing examples of its use.

Keywords: Artificial intelligence, Generative AI, Automate, Informate, Transformate, Microsoft Copilot, IS Pedagogy

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AI in IS Education: A Categorization of ISCAP Publications Using Zuboff's Automate–Informate–Transformate Framework

Jason H. Sharp, John E. Anderson and Guido Lang

The authors acknowledge the use of Microsoft Copilot to generate material included in this paper. This material was properly cited using APA style recommendations as with all cited material.

1. INTRODUCTION

"Technology will never replace great teachers, but technology in the hands of a great teacher can be transformational." – George Couros on X (2014)

Since the release of OpenAI's ChatGPT in late 2022, and subsequent platforms like Google Gemini, Microsoft Copilot, Anthropic's Claude, and X's Grok, the discussion about Artificial Intelligence (AI), Generative Artificial Intelligence (GenAI) and Large Language Model (LLM) usage in education has been seemingly endless. The myriad of academic papers, books, popular press articles, professional development workshops, and webinars has skyrocketed. Topics range from cheating and plagiarism, bias, privacy, individualized learning, course development, and grading, just to name a few. Mew and Money (2024) discuss the ability to leverage ChatGPT to generate syllabi, lesson plans, quizzes, and homework assignments. A quick review of these sources reveals many specific ways in which to utilize AI in education such as content creation, grading, student feedback, data analysis, coding, chatbots, tutors, podcast, among other applications.

Given the meteoric rise of AI in higher education, information systems education notwithstanding, the present paper specifically examines Information Systems & Computing Academic Professionals (ISCAP) publications, including the Journal of Information Systems Education (JISE), Information Systems Education Journal (ISEDJ), and ISCAP conference papers, from the period of 2022 to the first half of 2025 which directly discuss the use of AI for pedagogical purposes and employs Microsoft Copilot, hereafter referred to as Copilot, and human authors to categorize and analyze the papers within the context of the automate-informate-transformate framework (e.g., Angeles, 2013; Zuboff, 1985). The goal is to identify whether AI is simply helping to automate our tasks, inform our practice, or transform our pedagogy and to begin to address the question, *how is AI being applied in IS education?*

2. AUTOMATE-INFORMATE-TRANSFORMATE FRAMEWORK

A central tenet of Zuboff (1985, 1988) is the identification of a "fundamental duality" of IT, the distinction between two types of information technology based on their impact: automating and informating. Automate refers to the use of IT to replace human actions or processes, to automate operations. It replaces human actions, particularly in manual and simple white-collar tasks, with the goal of gaining operational efficiencies, reducing costs, and increasing control and continuity. Automating can lead to deskilling of the human labor force. Informate describes IT's capacity to create information about the underlying processes and work being performed through it. This process makes events, objects, and processes visible, knowable, and shareable in new ways. Informating creates a new resource that organizations can use to learn and improve, offering a potentially more penetrating, comprehensive, and insightful grasp of the business. This capacity can serve as a catalyst for significant improvement and innovation. Informating demands new intellective skills, which are abilities needed to learn from, adapt to, and interact with IT systems. It can lead to organizations becoming "learning institutions" and textualizes work, requiring new intellectual effort.

Zuboff argued that these two potentials of IT have profound implications for work, skills, authority, and power within organizations. Based on her ethnographic research, she delineated several dilemmas stemming from this duality. For example, at the work-practice level, IT replaces physical skills but creates a demand for intellective skills, presenting a dilemma of knowledge. At the organizational level, where workers gaining intellective skills might threaten management's position, potentially leading management to amplify the automating potential and reduce the informating potential to prevent worker learning, thus a dilemma of authority. However, the sources suggest such efforts may

not be sustainable due to the inherent informating capacity of IT. The dilemma of technique arises when management uses informating potential for rigid labor control rather than encouraging workers to learn about their work. Zuboff believed this strategy would ultimately damage organizational competency. (Xing & Sharif, 2025).

Zuboff's theory is seen as both idealistic, in highlighting IT's potential, and critical, in stressing how those in power may tend to prioritize their authority over realizing this potential. Zuboff argued that managers must ultimately choose a more idealistic path. Orlikowski (1992 p. 401) referred to this as Zuboff's 'Strategic Choice' model. Zuboff also suggested that market competition might also force managers to leverage informating for survival. Her theory incorporates both deterministic elements (IT offers dual potential, creates dilemmas requiring choice) and emergent elements (specific outcomes can be unpredictable) (Burton-Jones, 2014).

More recent researchers have followed the reskilling thesis. Orlikowski (1988) thought IT could be implemented to enrich the processes which define the work. The objective of informated technology is to remove the most boring, repetitious, dangerous and mindless tasks from work, leaving human labor to perform the creative, challenging, intellectual, and satisfying work. Palmer and Blake (2018) emphasize the potential of the current generation of smart technology to render traditional skills obsolete yet also force requirements and provide opportunities for employees to engage in lifelong learning and reskilling. In their book they argue that superior organizations must nurture an environment conducive to employee learning.

While Zuboff's primary framework includes "automate" and "informate," some researchers have extended or related her concepts to a third dimension, "transformate". Transformate refers to using IT to restructure business models, processes, practices, assets, capabilities, and relationships to create new value, products, markets, or reposition the firm (Angeles, 2013). Shein (1992) was the first to add this next level with the label "The Vision to Transform" as a CEO mindset for using IT as a basis for completely transforming their organizations by changing its relationships with suppliers and customers, altering products, markets, and organizational structures. Ogawa (2020) defined a version of "transformate" naming it Digital Transformation (DX) and defined it as creating new value by changing business processes through the use of digital technology and data, and argued that the value created by DX goes beyond Zuboff's automate and informate, constituting a new type of value. Even McKinsey (2025) has a new "tranformate" label, describing the next wave of AI maturity as developing "superagency," where employees combine AI with human creativity to transform operations and unlock new value.

Researchers have applied or extended Zuboff's ideas to different types of IT, such as Enterprise Resource Planning (ERP) systems and Management Support Systems (MSS), and to different types of workers, such as physicians (Burton-Jones, 2014). Zuboff's concepts have also been used in frameworks like the Technology-Organization-Environment (TOE) framework to study IT adoption in contexts like environmental sustainability and RFID systems (Angeles, 2013) and applied in the context of understanding value realization from big data (Gunther, 2017).

An analysis of citations to Zuboff's 1988 book in top IS journals between 1988 and 2011 indicates its sustained influence. The concept of informating is the most commonly referenced idea. While all elements of Zuboff's detailed theoretical model were referenced by at least some researchers, engagement with the full theory has been limited and piecemeal. Researchers referred much more to the concepts in her theory than to the relationships she posed among them, which are essential for understanding the process of change she described. Despite being widely cited, the review found only one conceptual critique and no empirical tests of Zuboff's theory within the examined IS literature during that period. This suggests that some ideas in her work have been overlooked or not deeply engaged with. Some critics have noted that many who cite Zuboff tend to focus solely on the positive aspects of informating, potentially overlooking the political implications and power dynamics she also discussed, where managers might frustrate the promise of informating by acting in self-interest
However, with recent calls in IS for more holistic accounts, socio-technical thinking, and attention to power, Zuboff's work remains highly relevant and potentially underutilized. There are opportunities for future research to engage in more in-depth and critical examinations of her theory, potentially extending it to new contexts or using simulation methods (Burton-Jones, 2014). It is with this call in mind and with its relevancy and underutilization, that Zuboff's framework is applied for this study.

3. METHODOLOGY

Beginning in 2022, the launch of OpenAI's ChatGPT (Ortiz, 2023b) and subsequent release of numerous other LLMs, the authors conducted a manual search of each volume of JISE and ISEDJ as well as the proceedings of the ISCAP Information Systems and Computing Academic Professionals Conference following a purposeful sampling approach through convenience sampling techniques (Patton, 1987, 2002). Papers addressing AI prior to 2022 were not considered as these were pre-current day LLMs. The search was conducted in June 2025, so only papers published in the first half of 2025 were available at that time. Using the JISE, ISEDJ, and ISCAP Conference Proceedings websites, the authors examined the paper titles for each volume and proceedings year searching for AI-related terms such as artificial intelligence (AI), generative artificial intelligence (GenAI), large language models (LLMs), ChatGPT, Claude, Gemini, etc. After the list of papers were compiled, the authors reviewed the text of each paper to deduce its relevancy. Using Copilot, each paper was evaluated and categorized as automate, informate, or tranformate based upon the above-mentioned definitions. The prompt used for Copilot is provided in Appendix A. Additionally, each author independently reviewed and categorized each paper. This followed the directed content analysis approach (Hsieh & Shannon, 2005), whereby automate, informate, and transformate served as the coding categories.

With regards to the interrater reliability (McHugh, 2012), there was unanimous agreement (100%) for the categorization of sixteen of the eighteen papers. For the remaining papers, there was partial agreement (67%). This resulted in an overall inter-rater reliability between the authors of 96%. When including Copilot's categorization, there was unanimous agreement (100%) for thirteen of the eighteen papers. For two papers, the categorization was split equally between Copilot and one author and the other two authors (50%). In the three remaining papers, the Copilot categorization differed from the authors, who were all in agreement (75%). In sum, when including all raters, AI and human, the inter-rater reliability was 92%. Interrater reliability of 90% or higher is generally considered excellent. Overall, the authors were very satisfied with the categorization and analysis provided by Copilot as well as the level of agreement.

4. RESULTS

A total of eighteen papers published in the target outlets were published between 2022 and the first half of 2025. Of the eighteen papers, one (6%) was published in 2022, two (11%) in 2023, nine (50%) in 2024, and six (33%) in the first half of 2025. The vast majority (15, 83%) of papers are categorized as informate. Only three (17%) papers are categorized as automate and none as transformate. Details about how each paper was categorized can be found in Appendix B. Figure 1 depicts the distribution of papers by year and category.

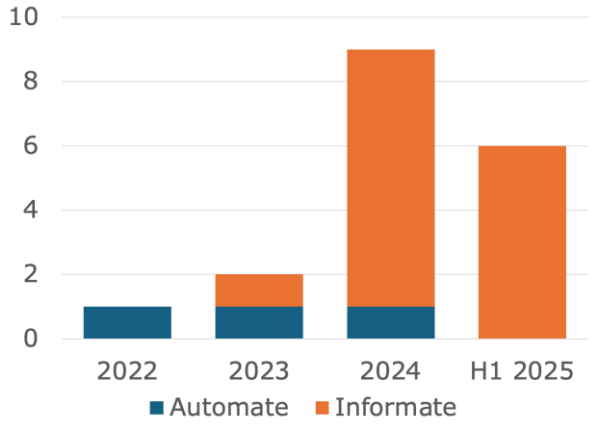


Figure 1: Distribution of Papers by Year and Category

Automate

Three (17%) out of eighteen papers were categorized as automate. To automate simply means to use IT to replace human actions or processes (Zuboff, 1985, 1988). In the case of GenAI, Rutner and Scott (2022) provide an exemplar. There was unanimous agreement between Copilot and the authors that the use of AI to grade asynchronous online discussion boards is appropriately categorized as automate. Other examples include the creation of quizzes, exams, assignments, or auto-grading code. All course elements that instructors have manually created in the past without the assistance of GenAI. The goal of automation is speed and efficiency. That is, take a time-consuming task and reduce the time and effort needed to complete it. Copilot specifically cites, replacement of human tasks, increase in operational efficiency, reduction in cost, standardization and control, and the potential for deskilling as reasons for its categorization (Microsoft, 2025).

Informate

Fifteen of the eighteen papers (83%) were ultimately categorized as informate. Because

informate was the largest category and represented the greatest agreement between AI and human raters, it might be of interest to describe the characteristics identified by Copilot in deducing its categorization. Five papers fell into the innovation and organizational learning category. Eight papers were categorized into the improvement of academic programs area. Two papers represented educational content creation. Five papers aligned with the idea of organizations as learning institutions. Notably, all fifteen papers were included in the intellective skill category representing critical thinking, engagement, interpretation, and reflection. Ten papers were categorized by transparent and analyzable learning processes. Eight papers supported reflective learning and future pedagogical strategies. Four papers supported learning institutions, insight generation, and adaptability to technological change. Finally, one paper emphasized the process of making unstructured data knowable and actionable (Microsoft, 2025).

Transformate

Of the eighteen papers included in the study, none were ultimately categorized as transformate. Four papers were initially categorized as transformate by either Copilot or one of the authors, but upon further discussion none remained as examples for transformation in the spirit of using IT to restructure business models, processes, practices, assets, capabilities, and relationships to create new value, products, or markets, or to reposition the firm (Angeles, 2013).

Although no papers were categorized as transformate in the final analysis, it might be helpful to consider transformate examples from another domain to facilitate ideas of how transformate might apply in IS education. Angeles (2013) applied the automate-informate-transformate framework within two recycling programs at Hewlett Packard (HP) Brazil and the city of Grand Rapids. The main finding at HP was the transformation from a "cradle-to-graveyard" to "cradle-to-cradle" model promoting environmental sustainability. For the city of Grand Rapids, the transformation involved changing the business model for refuse collection services to encourage recycling and composting.

Human versus LLM Categorization

While the previous paragraphs report on the results in terms of the "numbers" and provide initial reasoning, it might be of interest to examine the specific instances where human differed from LLM, in this case where the authors differed from Copilot in categorizing papers. There were five instances as shown in Table 1:

Paper	C	A1	A2	A3
Firth & Triche (2024)	T	I	I	T
Lang et al. (2024)	I	A	A	A
Memmert et al. (2023)	T	I	I	I
Sing et al. (2023)	T	A	A	A
Triantoro et. (2024)	I	I	T	I

Table 1 Human vs LLM

In cases where authors disagreed, they were able to discuss among themselves their reasonings and basically ask, *"what were you thinking?"*. The question then becomes, *"where Copilot disagreed with the authors in its categorization, how can its reasoning be ascertained?"*. In essence, what was Copilot *"thinking"*? Fortunately, Copilot provided an explanation of *"why"* it categorized each paper as either automate, informate, or transformate, and also why the paper was not categorized as the others (see Appendix C for full explanations). A review of the explanations reveals that Copilot

The first paper, Firth and Triche (2024) was split between transformate (Copilot and one author) and informate (two authors). The two authors arguing for informate cited that the use of GenAI in this case contributed to the learning process and intellectual skill development of the student more so than the creation of the deliverables, in that the use of GenAI to produce video content and a cover letter are demanding new intellective skills, which are abilities needed to learn from, adapt to and interact with its systems (Zuboff, 1988). On the other hand, the dissenting author considered having GenAI make a text generated video (automate) and AI generated cover letter (automate) with a student assessment (informate) combined to be a transformative experience in that the students create a new valuable product that they probably would not have been able to do by themselves without considerable training. Copilot cited restructuring educational practices, repositioning the role of MIS education, and enabling new capabilities and relationships. As such, this use of GenAI "is not just a tool enhancement, it redefines how students engage with content, assignments, and skill development" (Microsoft, 2025).

While there was consensus between Copilot and the authors that auto-grading discussion boards are clearly automate, the two papers applying AI to create case studies (Lang, Triantoro, & Sharp, 2024; Singh, Samborowski, & Mentzer, 2023) were not unanimous. In fact, in both instances, Copilot alone differed from the authors. While all three authors identified this application as

automate, Copilot categorized this application as informate (Lang, Triantoro, & Sharp, 2024) and transformate (Singh, Samborowski, & Mentzer, 2023), respectively. Each author considered the use of AI to create case studies as replacing human action on the part of the instructor. Rather than the instructor manually spending time and effort to create the case study, they feed a prompt to AI and let it do the work. In their perspective, this should be considered automate.

The next paper, Memmert, Tavanapour, and Bittner (2023) was categorized as transformate by Copilot, but as informate by all three authors. Due to the nature of the illustrative prototyping tool created, the authors felt like its primary goal was to provide information to address common challenges encountered in Design Science Research rather than provide a transformative experience. Copilot, on the other hand, identified a number of elements it considered transformative such as restructuring educational practices, enabling capabilities and relationships, creating new value, and positioning for future educational models. Copilot asserts that the novel AI-powered tool "fundamentally changes how students engage with Design Science Research" (Microsoft, 2025).

The final paper, Triantoro, Rua, and Lang (2024) was categorized as informate by two authors and Copilot, but as transformate by one author. The author believed that the utilization of Kolb's Experiential Learning Theory to teach GenAI to entrepreneurs went beyond the simple transmission of information and intellectual skill development through the use of the four stages concrete experience, reflective observation, abstract conceptualization, and active experimentation. Ergo, increasing AI literacy and technological competency is transformative. Copilot differed in its categorization citing creation of new understanding through interaction with IT, development of intellective skills, textualizing and reflecting on work, and increasing innovation and improvement. Copilot argues that enhancement of student attitude and perceived benefit, and understanding of AI are "classic examples of developing new intellective skills – learning how to interact with and learn from IT systems" (Microsoft, 2025).

5. DISCUSSION & CONCLUSION

In general, instructors are interested in using AI to help them automate the more mundane and time-consuming tasks, while at the same time they are reluctant to allow students to automate tasks for concern that critical thinking and skill building will be lost. Educators may fear that AI automation in both IS education and IS practice could lead to deskilling (Jarrahi, 2019; Nazir et al., 2024), reduced memory recall and less mental engagement. These negative consequences have been shown to be real by a study of a team at the MIT Media Lab (Kosmyna et al., 2025).

The results show that the majority of papers fall under the informate category, suggesting that many educational applications of AI focus on enhancing visibility into learning processes, supporting reflection, and developing new intellective skills. Tools like ChatGPT and Copilot are primarily used to generate content (e.g., code, questions, cases), support student understanding, and encourage critical thinking and self-assessment. This indicates that educators are leveraging AI to augment, not replace, human learning and teaching.

This aligns with constructivist and experiential learning theories, where understanding and engagement are prioritized over efficiency. Jarrahi (2019) wrote about the positive and negative potentials of AI automating and informating work. He noted that AI automation may be a source of human cognitive complacency and de-skilling. He argued for an informate rather than fully automate strategy, a human in the loop approach, which would value the abstract thinking and judgment that humans can provide. This also prevents what Nazer et al. (2024) term the "perilous route to disaster" which describes the movement toward automating complex problems because it adversely affects the user skill and capability in changing environments. This "human in the loop" approach and advocation for informating over automating seems to have pedagogical implication as well to prevent cognitive complacency and de-skilling among students.

Transformate is still emerging. A few papers demonstrate how AI can restructure educational models, such as redefining instructor and student roles, enabling scalable, personalized learning experiences, and creating new pedagogical frameworks. These cases hint at AI's potential to transform education, but such applications are still in early stages. However, much of what is promoted as transformational is really in essence automation or information. Areas which may represent transformate include restructuring educational practices, creation of new value, repositioning the role of IS education, creation of new capabilities and relationships, and transforming the learning environment. As

advances in AI technology continue, its transformating power will certainly increase.

The study is not without limitations. The first is the limited scope. The study only included ISCAP publications rather than the broader corpus of IS education literature. Second, the small number of papers categorized potentially skewing the results in terms of the use of AI for automate, informate, or transformate. Third, there may have been self-selection in the data, whereby educators are more likely to publish work about informate approaches than about automate approaches to teaching with GenAI. These limitations, however, do give rise to future research opportunities such as expanding the scope to include a broader search of IS education literature, thus increasing the number of papers and hopefully reducing self-selection bias somewhat, creating a visual framework, and examining what prior IS education literature has not yet done with the automate-informate-transformate lens.

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APPENDIX A: PROMPT USED

Given the following definitions, review the attached paper and categorize it as either automate, informate, or transformate: Automate refers to the use of IT to replace human actions or processes, to automate operations. It replaces human actions, particularly in manual and simple white-collar tasks, with the goal of gaining operational efficiencies, reducing costs, and increasing control and continuity. Automating can lead to deskilling of the human labor force. Informate describes IT's capacity to create information about the underlying processes and work being performed through it. This process makes events, objects, and processes visible, knowable, and shareable in new ways. Informating creates a new resource that organizations can use to learn and improve, offering a potentially more penetrating, comprehensive, and insightful grasp of the business. This capacity can serve as a catalyst for significant improvement and innovation. Informating demands new intellective skills, which are abilities needed to learn from, adapt to, and interact with IT systems. It can lead to organizations becoming "learning institutions" and textualizes work, requiring new intellectual effort. Transformate refers to using IT to restructure business models, processes, practices, assets, capabilities, and relationships to create new value, products, or markets, or to reposition the firm.

APPENDIX B: INDIVIDUAL PAPER CATEGORIZATION RESULTS

A=Automate, I=Informate, T=Transformate

Article	Copilot	Author 1	Author 2	Author 3	Final
Bekkering & Harrington (2025)	I	I	I	I	I
Firth & Triche (2024)	T	I	I	T	I
Frydenberg, Xu, & Xu (2025)	I	I	I	I	I
Jiang Nakatani (2025)	I	I	I	I	I
Lang & Gürpinar (2025)	I	I	I	I	I
Lang, Triantoro, & Sharp (2024)	I	A	A	A	A
Liu & Downing (2024)	I	I	I	I	I
Marquardson (2024)	I	I	I	I	I
Memmert, Tavanapour, & Bittner (2023)	T	I	I	I	I
Rutner & Scott (2022)	A	A	A	A	A
Singh, Samborowski, & Mentzer (2023)	T	A	A	A	A
Sun & Deng (2025)	I	I	I	I	I
Sundberg & Holmström (2024)	I	I	I	I	I
Triantoro, Rua, & Lang (2024)	I	I	T	I	I
Walden, Caporusso, & Atnafu (2022)	I	I	I	I	I
Yoo & Kim (2024)	I	I	I	I	I
Zhang (2025)	I	I	I	I	I
Zhong & Kim (2024)	I	I	I	I	I

APPENDIX C: COPILOT CATEGORIZATION AND REASONING

Firth and Triche (2024)

Based on the definitions you provided and a thorough review of the paper titled **"Generative AI in Practice: A Teaching Case in the Introduction to Management Information Systems Class"** by Firth and Triche, the most appropriate categorization is **transformate**.

Categorization: Transformate
Why it fits "Transformate":

- **Restructuring Educational Practices**: The paper introduces a new pedagogical model that integrates generative AI tools (e.g., ChatGPT, D-ID, ElevenLabs, Midjourney) into the curriculum. This is not just a tool enhancement—it redefines how students engage with content, assignments, and skill development.
- **Creation of New Value**: Students are taught to become "prompt engineers," a role that is emerging in the AI-driven workforce. This positions them for new career paths and redefines the value of MIS education.

- **Repositioning the Role of MIS Education**: The course shifts from traditional content delivery to experiential, AI-driven learning. Students create AI-generated videos and cover letters, reflecting a transformation in both the learning process and its outputs.
- **New Capabilities and Relationships**: The assignments require students to interact with multiple AI platforms, develop cross-functional digital skills, and reflect on their outputs. This fosters new capabilities and a deeper relationship with technology.

Why it is not "Automate":

- The focus is not on replacing human tasks with AI to gain efficiency. Instead, students are actively involved in creating, evaluating, and refining AI-generated content.
- There is no deskilling; rather, students are upskilled in prompt engineering, critical thinking, and digital literacy.

Why it is not "Informate":

- While the project does involve learning and insight generation (a hallmark of informating), the scope goes beyond making processes visible or knowable.
- The initiative fundamentally changes the structure and goals of the course, which aligns more with transformation than with information enhancement.

Conclusion:
This teaching case exemplifies **transformate** because it uses IT (generative AI) to **restructure educational processes**, **create new learning outcomes**, and **prepare students for emerging roles** in a rapidly evolving digital economy.

Lang, Triantoro, & Sharp (2024)

Based on the definitions you provided and a thorough review of the paper titled **"Large Language Models as AI-Powered Educational Assistants: Comparing GPT-4 and Gemini for Writing Teaching Cases"**, the study most closely aligns with the **informate** category. Here's the reasoning:

Categorization: Informate
Why it fits "Informate":

- **Creation of New Information**: The study explores how large language models (LLMs) like GPT-4 and Gemini can generate teaching cases, which are new forms of educational content. This aligns with the idea of IT systems making work processes visible and knowable in new ways.
- **Insight Generation**: The paper evaluates the outputs of LLMs using both subjective (e.g., relevance, creativity) and objective (e.g., readability indices) metrics. This process surfaces new insights about the capabilities and limitations of AI in educational content creation.
- **Learning and Adaptation**: The authors emphasize how LLMs can support educators in developing fresh, relevant teaching materials, potentially transforming institutions into more adaptive, learning-focused environments.
- **Intellective Skills**: The use of LLMs in this context requires educators to develop new skills in prompt engineering, critical evaluation of AI-generated content, and integration of AI tools into pedagogy—hallmarks of informating.

Why it is not "Automate":

- The study does not focus on replacing human labor or automating a repetitive task. Instead, it augments human capabilities in content creation.
- While LLMs reduce the time and effort needed to write cases, the process still requires human oversight, evaluation, and refinement.

Why it is not "Transformate":

- The paper does not propose a fundamental restructuring of educational institutions, business models, or markets.
- It explores enhancement of existing practices (case writing) rather than the creation of entirely new value propositions or organizational forms.

Memmert, Tavanapour, & Bittner (2023)

Based on the definitions you provided and a thorough review of the paper titled **"Learning by Doing: Educators' Perspective on an Illustrative Tool for AI-Generated Scaffolding for Students in Conceptualizing Design Science Research Studies"**, the most appropriate categorization is **transformate**.

Categorization: Transformate
Why it fits "Transformate":

- **Restructuring Educational Practices**: The paper introduces a novel AI-powered tool that fundamentally changes how students engage with Design Science Research (DSR). It shifts the instructional model from static, instructor-led guidance to dynamic, AI-generated scaffolding, enabling a more autonomous, iterative, and personalized learning process.
- **New Capabilities and Relationships**:
  - The tool integrates generative AI (GPT-3) to provide content-level support (CLS), which was previously infeasible due to the diversity of student-selected topics.
  - It redefines the student-instructor relationship by offloading some of the instructor's content-level guidance to the AI, allowing instructors to focus on higher-level feedback.
- **Creating New Value**:
  - The tool enables students to explore complex, ill-structured problems more effectively, potentially increasing the quality and depth of their research outputs.
  - It introduces a scalable model for supporting diverse student needs without requiring domain-specific preparation from instructors.
- **Positioning for Future Educational Models**:
  - The authors propose that this approach could be adapted to other creative problem-solving domains (e.g., design thinking), suggesting a broader transformation of how AI can be embedded in higher education.
  - The tool is part of a larger vision for a DSR tool support ecosystem, indicating a shift toward platform-based, AI-augmented learning environments.

Why it is not "Informate":

- While the tool does generate information (e.g., suggestions, rephrasings), its primary function is not to make existing processes more visible or analyzable. Instead, it actively reshapes the learning process by introducing new workflows and capabilities.
- Informating typically enhances understanding of current operations; this tool redefines how those operations are carried out.

Why it is not "Automate":

- The tool does not replace human tasks in a way that reduces labor or increases efficiency through automation. Instead, it augments human capabilities and encourages deeper engagement with the learning material.
- There is no evidence of deskilling; rather, the tool demands new skills in critical thinking, reflection, and AI interaction.

Conclusion:
This paper exemplifies the **transformate** category because it uses AI to restructure the educational process of learning DSR. It introduces a new model of human-AI collaboration in education, enabling scalable, personalized, and iterative learning that repositions both students and instructors in the learning ecosystem.

Singh, Samborowski, & Mentzer (2023)

Based on the definitions you provided and a thorough review of the paper titled **"A Human Collaboration with ChatGPT: Developing Case Studies with Generative AI"**, the most appropriate categorization is **transformate**.

Categorization: Transformate

Why it fits "Transformate":

- **Restructuring Educational Content Creation**: The paper demonstrates how generative AI (ChatGPT) is used not just to assist but to fundamentally change the way business case studies are developed. This shifts the traditional model of case creation from a months-long, faculty-driven process to a collaborative, iterative, AI-augmented workflow.
- **New Capabilities and Relationships**:
  - The use of ChatGPT enables rapid prototyping of case studies, dynamic customization for specific audiences (e.g., MBA working professionals), and integration of real-time business scenarios.
  - It redefines the educator's role from sole content creator to prompt engineer, curator, and ethical overseer of AI-generated content.
- **Creation of New Value**:
  - The paper highlights how generative AI can reduce the time and cost of developing educational materials, making it feasible to produce more timely, relevant, and customized content.
  - It introduces a scalable model for content generation that can be adapted across disciplines and institutions.
- **Repositioning the Institution**:
  - The approach positions the business school as a forward-thinking, tech-enabled institution capable of leveraging AI to enhance curriculum development and student engagement.
  - It also suggests broader applications, such as full course content generation and integration of AI into instructional design.

Why it is not "Informate":

- While the process involves generating information, the primary impact is not on making existing processes more visible or analyzable. Instead, it is about creating entirely new processes and outputs.
- Informating typically enhances understanding of current operations; this paper focuses on transforming how educational content is conceived and produced.

Why it is not "Automate":

- The AI is not simply replacing a manual task like grading or data entry. Instead, it is enabling a new form of human-AI collaboration that redefines the workflow and output.
- The educator remains actively involved in shaping, refining, and validating the AI-generated content, which goes beyond automation.

Conclusion:
This paper exemplifies the **transformate** category because it uses generative AI to restructure the process of educational content creation, enabling new capabilities, redefining educator roles, and creating scalable, customized learning materials. It reflects a strategic shift in how technology is integrated into academic practice.

Triantoro, Rua, & Lang (2024)

Based on the definitions you provided and the content of the paper titled **"Unlocking Generative AI Potential in Entrepreneurs: An Experiential Learning Approach"**, the most appropriate categorization is **informate**.

Categorization: Informate
Why it fits "Informate":

- **Creating New Understanding Through Interaction with IT**: The study focuses on teaching entrepreneurs how to use generative AI through experiential learning. Participants engage with AI tools, reflect on their use, and conceptualize how these tools can benefit their businesses—making the processes of AI use visible, understandable, and actionable.
- **Development of Intellective Skills**: The training enhances participants' understanding of AI, their attitudes toward it, and their perceived benefits. These are classic examples of developing new intellective skills—learning how to interact with and learn from IT systems.

- **Textualizing and Reflecting on Work**: The use of Kolb's Experiential Learning Theory (Concrete Experience, Reflective Observation, Abstract Conceptualization, and Active Experimentation) encourages learners to reflect on their experiences with AI, effectively textualizing their learning process.
- **Catalyst for Innovation and Improvement**: The program aims to empower entrepreneurs and small businesses by improving their technological competence and competitive advantage—using AI not just as a tool, but as a means to gain deeper insight and drive innovation.

Why it is not "Automate":

- The focus is not on replacing human tasks with AI to gain efficiency or reduce costs. Rather, it is on learning how to use AI effectively.
- There is no indication of deskilling; instead, the program is about upskilling.

Why it is not "Transformate":

- While the program may lead to long-term strategic benefits for entrepreneurs, it does not propose a restructuring of business models or markets. It enhances existing capabilities rather than fundamentally transforming them.

Conclusion:

This paper exemplifies the **informate** category because it uses generative AI as a tool to enhance understanding, develop new skills, and make the use of AI in entrepreneurship more transparent and actionable through experiential learning.