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TEACHERS 50+ AND ARTIFICIAL INTELLIGENCE – NOTES FROM PILOT STUDIES

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Abstract:
Background: This article presents the empirical findings of an exploratory pilot study investigating the attitudes of senior pedagogical staff (aged 50 and above, conceptualized as the "digital immigrant" cohort) toward the implementation of Artificial Intelligence (AI) in educational environments. Contextualized within the demographic shift of an aging teaching workforce and the concurrent challenges of hyper-digitization. **Methods:** The study assessed the cognitive, affective, and behavioral components of these attitudes utilizing the Attitudes Towards AI in Education Scale (SPAI-E) on a sample of 88 practitioners. **Results:** The data reveal a predominantly neutral attitudinal stance, marginally skewed toward skepticism, accompanied by significant intragenerational variance; notably, educators over the age of 60 exhibit a more pronounced conservative disposition compared to the 50–59 demographic. Notwithstanding the presence of cognitive and affective barriers, such as technostress, the subjects demonstrate an elevated behavioral readiness to engage in practical applications and professional development. **Conclusion:** The findings underscore the pragmatic orientation of senior educators, concluding that the optimal integration of AI necessitates targeted institutional scaffolding aimed at cultivating digital resilience.

Keywords: artificial intelligence; educational technology; digital immigrants; attitudes toward AI; technostress; digital resilience

The Digital Breakthrough and the Normative Crisis in the Educational Space

The contemporary socio-economic reality is undergoing rapid transformations, the primary catalyst of which has been the development of digital technologies, including advanced artificial intelligence systems. This process, referred to as the Fourth Industrial Revolution, penetrates the deepest layers of the social fabric. The transition toward an algorithmic paradigm reconfigures the existing frameworks of human interaction. These transformations are characterized by an exponential growth rate, rendering traditional adaptation mechanisms insufficient. The information architecture of the modern world alters the modes of knowledge internalization, identity formation, and the accumulation of social capital. Consequently, technology ceases to be merely a tool supporting activity; it becomes an existential environment determining new forms of social stratification.

The abruptness of these processes generates significant structural tensions, leading to profound shifts in value systems and the destabilization of existing institutions. In conditions of technological fluidity, traditional moral norms lose their regulatory power before new behavioral patterns, adequate to the digital universe, can emerge. This phenomenon is directly related to the category of anomie, understood as a state of disorientation and normative relaxation. The lack of synchronization between the pace of technical development and the adaptive capabilities of society evokes a profound sense of alienation. Value systems undergo relativization when clashing with the new imperatives of automation.

This situation within the Polish scientific discourse has been diagnosed by researchers of structural changes. They point out that modernization processes, devoid of axiological reflection, lead to the disintegration of social order. As Galas and Wylężałek (2019) indicate, this crisis affects the foundations of the social order, causing institutional decision-making paralysis. This occurs because anomie, under conditions of rapid technological change, manifests itself as a divergence between dynamically generated needs and the absence of socially sanctioned rules for satisfying them [5].

This normative disorganization destabilizes the traditional footholds of the individual, which impacts socialization processes and generates a state of permanent uncertainty in social macro- and microstructures.

The described destabilization of the normative order exerts a profound influence on the sphere of education and upbringing. The school and other educational institutions, traditionally functioning as the primary transmission belts of culture, have found themselves in an identity crisis. Education can no longer rely on the static transmission of knowledge, as it undergoes rapid obsolescence under the influence of permanent informational innovation. The younger generation, growing up in a world dominated by algorithms, shapes its attitudes based on stimuli entirely different from those available to traditional pedagogy. In this context, upbringing processes become hindered, and the teacher ceases to be the sole source of cognitive authority. The lack of coherent regulatory frameworks regarding the presence of AI in the educational space exacerbates the state of pedagogical helplessness, leading to the phenomenon of educational anomie.

In the face of these challenges, a fundamental modernization of the educational and upbringing spheres becomes a crucial imperative. However, it cannot consist solely of a superficial digitization of educational institutions or the mechanical equipping of classrooms with computer hardware. A profound, paradigmatic reconstruction of didactic processes is necessary, combining the rigor of computer sciences with humanistic reflection on the human condition. This modernization must encompass curricula and a redefinition of the professional competencies of the pedagogical staff. Computer science education should not be treated as a separate discipline but as an integral component of shaping critical thinking and ethical responsibility. Contemporary pedagogy must develop new methodological strategies that will allow students to function subjectively in a technology-saturated environment, transforming passive consumption into creative cognitive activity.

The necessity of integrating the technological dimension with humanistic goals is widely raised in global digital pedagogy. Researchers indicate that the unreflective implementation of innovations, devoid of grounding in social theory, yields counterproductive results. As Selwyn (2016) observes, technology is not neutral, but carries specific cultural implications redefining the essence of the pedagogical relationship: "Educational technology cannot be understood separate from the wider social, economic and political relations within which it is embedded" [11].

In the reality of Polish schools, however, this embedding of technology in a social context encounters structural resistance, resulting from the competency mismatch of the teaching staff.

For this reason, designing research on teachers' attitudes toward artificial intelligence, particularly in groups with longer work experience, assumes crucial importance. Recognizing the cognitive barriers, emotional anxieties, and behaviors of educators in the face of the digital revolution constitutes a starting point for building rational modernization strategies. Only through a profound understanding of how algorithmization affects the school microsystem and how it triggers anomic or adaptive states in individuals responsible for socialization, is it possible to design effective support programs. The present study aligns with this trend, striving to map the attitudes of 50+ teachers in a world dominated by AI.

Educational Benefits of Artificial Intelligence

Contemporary education functions in the era of liquid modernity and the phenomenon of hyper-digitization, which permanently transform the paradigms of learning and teaching. In this context, artificial intelligence (AI) has evolved from a futuristic concept into the role of a real, extremely powerful didactic and analytical instrument [4; 12]. The implementation of systems based on machine learning, natural language processing (NLP) algorithms, and generative artificial intelligence redefines educational processes, creating unprecedented optimization opportunities. These possibilities are not limited to a single sector but encompass the entire spectrum of the education system and higher education. The appropriate and thoughtful use of AI supports the creation of "Augmented Intelligence," where computers take over routine and analytical tasks, liberating human potential for activities requiring empathy, creativity, and critical thinking [6]. The following analysis systematizes the main benefits of using artificial intelligence at various levels and in different fields of education.

Systemic and Administrative Level At the macroeconomic and systemic level of education, artificial intelligence provides powerful analytical tools for managing massive data volumes (*learning analytics*). A key solution lies in Early

Warning Systems (EWS), which use predictive algorithms to analyze micro-data regarding attendance, student engagement in Learning Management Systems (LMS), and academic progress. They allow for the early identification of students at risk of early school leaving (*dropout*) or exclusion. This gives educators time to implement appropriate interventions before the problem manifests itself in negative grades [8]. Furthermore, predictive outcome analysis can correlate current evaluations with historical trends, facilitating schools in the early recognition of hidden educational regression [4].

Support for the Teacher's Workshop (Primary and Secondary Education) From the perspective of teachers, AI acts as a digital assistant that radically reduces bureaucratic burdens. Advanced work environments allow for the instantaneous generation of school documentation, dynamic outcome plans, and lesson materials [4]. An extraordinary value lies in automating the preparation of cumbersome psychological and pedagogical assistance documentation, such as Individual Educational and Therapeutic Programs (IPET) or Multidisciplinary Assessments of the Student's Level of Functioning (WOPFU). The automation of such processes saves 5 to 6 hours of work per week, allowing the teacher to focus on building a mentoring relationship with their students [4]. This technology is also evolving toward Automatic Writing Evaluation (AWE). Advanced systems can correct errors in thousands of essays, providing students with immediate, formative feedback [6]. In the era of so-called algorithmic plagiarism, this facilitates the transition to a process-oriented assessment model, where the evolution of the student's thinking is verified (e.g., the reverse engineering essay concept), rather than merely the final product [4].

Personalization of Teaching and Intelligent Tutoring Systems The most revolutionary benefit in the process of knowledge acquisition is the phenomenon of mass individualization of education. Schools successfully utilize Intelligent Tutoring Systems (ITS), which function analogously to a private tutor [6]. The architecture of these systems consists of a domain model (knowledge), a pedagogical model (strategies), and a dynamic student model. As a result, AI adjusts the difficulty level and pace of work to the cognitive profile in a fraction of a second, eliminating frustration caused by overly difficult tasks or boredom stemming from already mastered material [6]. The Open Learner Modeling additionally provides statistics to the learners themselves, supporting metacognition [13]. Utilizing AI, teachers can generate different versions of worksheets optimized for the unique mental profiles of students based on the typology of C.G. Jung and Cz. Nosal – effectively reaching, among others, introverted strategists and extroverted practitioners [4].

Special and Inclusive Education AI plays a profoundly significant role in supporting individuals with special educational needs (SEN). Tools based on algorithms constitute digital scaffolding here and are the foundation of the Universal Design for Learning concept. Text-to-Speech algorithms relieve the working memory of students with dyslexia or auditory processing disorders [4]; 13]. High contrast modes, distractor reduction, and the structuring of complex tasks into simple goal lists support youth with attention deficits (ADHD) and individuals on the autism spectrum [4]. Furthermore, intelligent, simultaneous translators and multilingual chatbots represent a massive facilitation for children with migratory experiences, enabling them to integrate into a new school environment without the exclusionary language barrier [8].

Vocational Education and Training (VET) and STEM Education Distinct benefits also reveal themselves in vocational education and training (VET) and disciplines within the STEM area (science, technology, engineering, and mathematics). Image generators can create photorealistic technical cross-sections of mechanical systems in real time, which enables the visualization of complicated or dangerous processes without the necessity of dismantling them in laboratories [4]. In turn, individualized conversational mentoring bots can reduce the gender inequality problem. Research has proven that the contact of female students with virtual mentors simulating scientific authorities significantly increases their sense of belonging to the scientific and technological environment, encouraging careers in deficit engineering professions [8].

Higher Education and Scientific Research In the academic space, artificial intelligence provides support in the process of analyzing massive textual datasets, assisting researchers and students in comprehensive literature reviews, compiling bibliographies, and formulating research questions [12]. Higher education is also an environment generating severe stress among young adults. In this regard, interventional and therapeutic chatbots offer round-the-clock support, effectively reducing anxiety states and mitigating depressive symptoms in students [12]. Today, university studies are also a space for the incubation of digital resilience, consisting of building immunity against technological challenges and shaping a critical attitude regarding the identification of the algorithmic "hallucination" phenomenon while acquiring knowledge from them [12].

The application of AI technologies at all levels of the educational process offers colossal corrective and optimizing potential. By lifting administrative burdens from educators' shoulders, implementing intelligent personalization on a massive scale, and equalizing opportunities for disadvantaged groups, artificial intelligence contributes to the modernization of the teaching apparatus. Technology should function here as an efficient artisan taking over routine operations, to facilitate the human master in realizing the most sublime ideas in shaping attitudes, building morality, and supporting the cognitive development of students.

Challenges Associated with the Aging of the Pedagogical Staff

The collision of the aging educational staff problem with the necessity of radically modernizing teaching methods is one of the greatest challenges of the contemporary education system. In the Polish education system, challenges associated with the aging of the pedagogical staff are observed, which requires precise planning of intergenerational exchange. Analyses and forecasts show that in many vocational professions (such as electronics technician, carpenter, or miner), the average age of teachers often exceeds 50 years, compelling the education system to account for a large scale of vacancies resulting from increasing retirements [2].

The problem of the aging teaching staff constitutes one of the most pressing challenges for the contemporary education system in Poland. This phenomenon manifests itself through the growing share of educators who have already reached retirement age yet still constitute the foundation of educational institutions' operations [2]. For analytical purposes in educational research, it is assumed that the retirement age is 60 years for women and 65 years for men [2]. Juxtaposing these data with the definition of "young teachers," which statistically includes exclusively individuals with very short work experience (not exceeding 5 years), clearly demonstrates a massive gap in the natural intergenerational exchange of staff in Polish schools [2].

The scale of this crisis is emphatically illustrated by hard data from the pilot forecast of demand for vocational teachers for 2025, prepared by the Educational Research Institute [2]. The difference in estimated staffing needs, calculated in variants with and without accounting for retirements, is drastic. As econometric analyses indicate (based on the highest-rated Model 1), the additional demand for new teachers in 2025 – after excluding retirees from this compilation – is relatively small for the entire country, at 1,233 individuals [2]. However, when the forecast includes the necessity of physically replacing staff reaching retirement age, the total demand abruptly jumps to the level of 6,728 vacancies [2]. The results of other applied models (e.g., Model 3 or 5) indicate an even deeper deficit, estimating total staffing gaps at over 8,200 workplaces [2]. This irrefutably proves that the stability of Polish vocational education is currently sustained to a vast extent by the decision of thousands of senior teachers to continue their employment.

This problem is not evenly distributed and particularly threatens the continuity of teaching in selected vocational specializations. Analyses show that in some professions, the mere retirement of older cohorts will generate the overwhelming majority of future staffing shortages. An illustrative example is education for the profession of an assistant to a disabled person – the forecasted natural growth in demand is merely 3 vacancies, whereas the variant accounting for retirements drives this need up to 16 new teachers nationwide [2].

The main causes of the deepening staff deficit should be sought not only in the demographic changes of the youth population aged 15–19, but also in the relative unattractiveness of the teaching profession to young people [2; Statistics Poland & Statistical Office in Gdańsk, 2025). Young university graduates too rarely choose a career path in schools; therefore, the attractiveness of this profession has become one of the most crucial variables in the macroeconomic modeling of education's future [2]. A rapid and effective generational exchange is meanwhile absolutely essential, especially in light of the structural reforms of vocational education being introduced, which increasingly rely on modern qualification frameworks and the European idea of lifelong learning [3].

On the other hand, the school must confront the era of hyper-digitization, which alters the demands placed on the human cognitive apparatus and necessitates a broad modernization of didactics [4]. The ubiquity of digital technologies and the "Google effect" phenomenon weaken the capacity for deep information processing and redefine cognitive autonomy, causing the role of older teachers to shift toward being "knowledge curators" and guides in a world of information noise [4]. Furthermore, the contemporary educational environment increasingly emphasizes the necessity of developing "digital resilience," namely the hardiness and ability to overcome technological difficulties and cope with the demands of online education [12].

For older teachers, meeting these new methodologies involves the necessity to adapt to digital paradigms:

- **Changing the philosophy of assessment:** Universal access to language models has led to the problem of so-called "algorithmic plagiarism," where cognitive effort is delegated to the machine, and the student's critical thinking is eroded [4]. Researchers warn that the abuse of tools such as ChatGPT leads to the atrophy of students' capabilities for independent analysis, synthesis, and accurate inference [13; 12]. Teachers must abandon grading solely the ready, final product in favor of process-oriented assessment, utilizing, among others, the concept of the "reverse engineering" essay, documentation of progress, and iterative monitoring of the student's successive drafts [4]. This forces the verification of skills based on practical projects and portfolios, which more effectively reflect real competencies in the contemporary labor market [9].

- **Coping with AI "hallucinations":** The fact that probabilistic algorithms can confabulate and fabricate information requires turning the contemporary classroom into a sort of "laboratory of truth" [4]. It must be remembered that data fed into systems may be false, and the models themselves often do not provide verifiable sources or authorship, threatening the mass dissemination of fake news [13; 12]. For this reason, the teacher is tasked with teaching the methodology of source evaluation (*fact-checking*) and lateral reading [4].

- **Implementing precision pedagogy:** Modern AI technologies provide unprecedented opportunities for the personalization of educational materials. AI integration enables the creation of systems such as Open Learner Modeling (OLM), which facilitate personalization and support students with special educational needs (e.g., via translators or applications for individuals with dyslexia and hearing impairments) [13]. Teachers capable of utilizing generative tools can tailor worksheets to the individual, unique cognitive profiles of students (based, for instance, on the typology of minds by C.G. Jung and Cz.

Nosal, dividing students into practitioners, strategists, visionaries, and harmonizers) [4].

However, the implementation of such advanced changes encounters a barrier linked to adult education and the Lifelong Learning system. Although structures such as the Polish Qualifications Framework (PRK) are being developed and implemented in Poland, practical activity in terms of investing in human capital and adult learning still remains relatively low [3]. To find their bearing in this dynamic reality, adult educators must adopt an attitude of "continuous reset" – a readiness to regularly unlearn outdated schemas and assimilate innovations [9].

Nevertheless, it is precisely artificial intelligence that can provide crucial and immense support for the age-experienced staff. On the one hand, algorithms assist in automatic evaluation and faster grading of assignments (e.g., e-Rater type tools) [13]. On the other, virtual assistants and intelligent environments (e.g., Google Workspace) allow for the automation of burdensome school bureaucracy, such as generating dynamic outcome plans or structured, individualized Educational and Therapeutic Programs (IPET) and WOPFU [13; 4]. The mature teacher can allocate the time resources and cognitive strength recovered in this way to what is currently most unique in their work and inaccessible to machines – the development of empathy, emotional support, direct integration, and building an invaluable mentoring relationship with the student [4; 9; 13].

Attitudes of 50+ Teachers Towards Artificial Intelligence

In the process of permanent modernization of school education, paradigmatic significance is attributed to the attitudes of teachers in the 50+ age group. As depositaries of pedagogical experience and leaders of pedagogical councils, and simultaneously representatives of the cohort of digital immigrants, they constitute a key link in the process of implementing technological innovations, including artificial intelligence (AI) systems. The structure of these attitudes, according to classic psychosocial conceptualization, has a multidimensional character and is constituted by three interactive components: cognitive, emotional, and behavioral [14]. It is worth emphasizing the three components of an attitude.

- The **cognitive component** reflects the state of the teacher's knowledge, beliefs, and opinions regarding the mechanisms and purposefulness of using AI in education. In the 50+ educators' group, this component is often characterized by a high degree of criticism. On the one hand, it relies on a profound awareness of educational goals, and on the other – given potential deficits in the area of technical understanding of algorithms – it can generate skepticism toward the declared effectiveness of large language model systems [15; 7]. Understanding the didactic utility of an innovation determines its cognitive legitimization by the experienced staff.
- The **emotional (affective) component** encompasses the spectrum of affective reactions – from technological anxiety (technostress) and a sense of threat to the traditional professional ethos, to excitement and hope for relief from routine administrative tasks. These emotions directly determine the level of adaptive resistance. Stabilizing the affective well-being of older teachers and reducing fears of losing authority form the foundation for overcoming barriers against the new medium.
- The **behavioral component** manifests itself in actual didactic actions, the routine of using digital tools, and the declared intention to upgrade IT competencies. This is the direct exemplification of attitude in school practice. As research on technology acceptance models proves, behavioral readiness (including the intention of active AI use in lessons) is a direct derivative of cognitive and emotional evaluation [16].

The conditioning of the 50+ generation makes their attitudes crucial for the success of educational modernization. The effective integration of artificial intelligence with the upbringing process requires treating this group subjectively through the stimulation of the cognitive component and the reduction of anxieties, which will directly translate into lasting, purposeful changes in their behavioral workshop.

The subject of the described exploratory, monographic pilot study was the multidimensional structure of the attitudes of 50+ teachers toward the implementation and functioning of artificial intelligence (AI) systems in the school environment. The analysis covers internal psychosocial determinants and cultural patterns specific to the cohort of "digital immigrants," which shape the degree of acceptance or resistance toward modern tools based on large language models (LLM) and data processing algorithms in the didactic and upbringing process of a selected educational institution. The study concentrates on the dynamic relationship occurring between well-established professional experience and the necessity to adapt to the digital work environment.

The main theoretical-cognitive and methodological goal of the undertaken pilot is a comprehensive diagnosis and an exhaustive description of the attitude structure of the 50+ pedagogical staff toward artificial intelligence. The specific goals of the project include the following areas:

- **Diagnostic goal:** Identification and classification of dominant attitude profiles (pro-technological, ambivalent, and skeptical-anxious) in the surveyed age group.
- **Methodological goal:** Evaluation of the internal consistency of the Attitudes Towards AI in Education Scale (SPAI-E) and precise selection of extreme cases for the execution of the second, qualitative stage of research (in-depth interviews).
- **Application goal:** Formulation of recommendations for psycho-pedagogical support programs and professional development systems for older teachers in the era of algorithmic transformation.

In the context of the adopted methodological design – a monographic exploratory pilot of a mixed (quantitative-qualitative) character – the formulation of hypotheses *a priori* is abandoned. The research process is guided by properly formulated research problems. They allow for maintaining the cognitive openness necessary to capture the specificity of the "digital immigrants'" (50+ teachers) attitudes toward the algorithmic transformation.

The main research problem has a descriptive-explanatory character and has been formulated as follows: *What is the nature of the attitudes of 50+ teachers toward the implementation of artificial intelligence in school education, and how are the individual components of these attitudes structured in the surveyed school community?*

To operationalize the main research problem and ensure consistency with the two-stage procedure (quantitative SPAI-E scale and interviews with extreme cases), three specific research questions were formulated:

1. To what extent do declarative knowledge and beliefs (the cognitive component) of teachers from the 50+ age group concerning artificial intelligence correlate with their perception of threats to the traditional ethos and professional authority?

2. What affective factors (the emotional component), with particular emphasis on technostress and the fear of digital exclusion, dominate the experience of 50+ teachers, and how do they influence the polarization of their attitudes?

3. In what way do the declared intentions and actual didactic actions (the behavioral component) of 50+ teachers differentiate their workshop depending on the degree of innovativeness and the technological climate of the surveyed institution?

No hypotheses were posited in the study because they have an exploratory character: "Exploratory research [...] is research leading to theory building. According to the adopted definition of a hypothesis, we cannot formulate it when there is no theoretical proposition" [10]. The above structure of problems and research questions meets the criteria of formal correctness according to the classic canons of social science methodology [10]. The questions are formulated in a decisive or complementary manner, do not suggest answers, and derive directly from the adopted variables and indicators.

In the adopted methodological paradigm, the precise extraction of variables and assigning them empirically measurable indicators is of key importance. Due to the two-stage, mixed character of the pilot, variables are subjected to quantitative-qualitative operationalization, which allows for maintaining high interpretative rigor.

The dependent variable, i.e., the Attitude toward AI in education, is treated as a complex hypothetical construct consisting of three closely interconnected structural components:

Table 1. Operationalization of Dependent Variables and Indicators

Cognitive Component (Knowledge and Beliefs):	Degree of declarative understanding of concepts related to artificial intelligence; beliefs regarding the impact of automation on the teacher's professional authority; evaluation of the cognitive and didactic utility of algorithms; perception of the ethical risk related to student plagiarism.
Emotional Component (Affective):	Intensity of perceived fear of technological exclusion (technostress); level of anxiety related to the potential loss of professional autonomy; level of curiosity, excitement, and satisfaction derived from exploring new digital functionalities.
Behavioral Component (Intentions and Actions):	Frequency of the operational use of AI for preparing lesson plans and didactic materials; declared intention of active participation in training; openness to modifying methods of working with youth.

Source: own elaboration

Independent and moderating variables are structural, socio-demographic, and biographical factors that may differentiate attitude profiles within the studied population:

Table 2. Operationalization of Independent Variables and Indicators

Age and Work Experience:	The exact age of the respondent (inclusion criterion: age equal to or greater than 50 years) and the total number of years worked in educational institutions.
Professional Status:	The degree of professional promotion (appointed teacher or chartered teacher).
Subject Profile:	The specificity of the taught discipline (division into humanities/social sciences and math/natural/exact sciences).
ICT Experience:	Self-assessment of basic digital competencies and the frequency of using traditional information and communication technologies in daily practice.

Source: own elaboration

The above operationalization of variables constitutes a coherent methodological foundation, enabling a reliable transition from quantitative measurement to the purposive sampling of an extreme group in the qualitative phase.

Research Instrument: Attitudes Towards AI Scale (SPAI-E) – Pilot Sheet

The prepared tool is a questionnaire intended for a monographic, pilot study of the attitudes of teachers in the 50+ age group (often referred to as "digital immigrants") toward the implementation of artificial intelligence in the didactic and upbringing process. Its primary diagnostic goal is the identification and classification of dominant attitude profiles (pro-technological, ambivalent, or skeptical-anxious) among the experienced pedagogical staff.

Structure of the research sheet: The SPAI-E instrument has an ordered structure and consists of four main parts:

1. **Demographics (Independent variables):** This part serves to collect socio-demographic and professional data. The respondent is asked to provide, among others, their age (inclusion criterion: >49 years), length of pedagogical work, degree of professional promotion, the main subject taught, and to specify the frequency with which they use traditional (non-AI-based) digital tools.

2. **Instructions for the respondent:** An introduction explaining how to provide answers based on a 5-point Likert scale, from 1 ("Strongly disagree") to 5 ("Strongly agree"), where the value 3 represents a neutral point ("Hard to say / I am indifferent").

3. **Likert Scale Questionnaire:** The core of the tool, containing 9 specific statements evaluating the teacher's attitude toward artificial intelligence.

4. **Key for the researcher:** An instruction invisible to the respondent defining the assignment of questions to attitude components and the rules for converting points.

Three-dimensional attitude model: In accordance with classical psychosocial concepts, SPAI-E operationalizes attitude as a complex hypothetical construct, examining it at three interactive levels:

- **Cognitive Component (statements 1, 2, 3):** Diagnoses the state of the teacher's knowledge and beliefs regarding the mechanisms and purposefulness of using AI. These statements examine belief in the revolutionary impact of AI on didactic materials, opinions about the ability of algorithms to evaluate human creativity, and the conviction of whether knowledge about AI is an indispensable element of the educator's toolkit today.

- **Emotional Component (statements 4, 5, 6):** Analyzes affective reactions, including the level of the so-called technostress phenomenon. The questions verify the teacher's fear of their competencies being replaced by machines, concerns about the shallowing of youth's critical thinking skills, and – opposing these – curiosity related to the use of novelties such as ChatGPT.

- **Behavioral Component (statements 7, 8, 9):** Indicates readiness for actual actions and the training intentions of respondents. It checks, among others, whether the teacher intends to test AI tools in the current semester, whether they will willingly participate in dedicated training, and to what extent they avoid technologies whose mechanism of action seems too complicated to them.

Coding and interpretation of results: To calculate the overall Attitude Index, the researcher must apply reverse coding for negatively formulated statements or those indicating skepticism (statements no. 2, 4, 6, and 8). In these cases, the values are inverted (e.g., a "1" circled by the respondent is converted to 5 points, and a "2" to 4 points).

In the broader context of the entire research project, the SPAI-E scale serves a highly important methodological function: aside from the quantitative analysis itself, it enables the selection of subjects with extreme scores. Individuals presenting the most distinct enthusiasm or the strongest resistance can subsequently participate in in-depth qualitative interviews (Stage II), which ultimately allows for the formulation of accurate recommendations for professional development systems for senior teachers.

Research Procedure and Results

The presented study was designed as an exploratory monographic pilot, embedded in a mixed research design (quantitative-qualitative). Due to the cognitive goal, directed at diagnosing an emerging phenomenon, the formulation of hypotheses *a priori* was abandoned in the project. Such an approach forms the foundation of grounded theory, in which the researcher does not verify ready-made assumptions but strives to generate concepts and theories directly from the acquired empirical data. The research process was thus guided exclusively by the main problem of a descriptive-explanatory nature, concerning the character of 50+ teachers' attitudes toward AI.

Compliance with grounded theory manifests itself most clearly in the innovative and flexible approach to sampling. Stage I (quantitative), carried out using the Attitudes Towards AI in Education Scale (SPAI-E), served the function of so-called initial (preliminary) sampling in this model. According to the principles of grounded theory, at an early stage, the researcher does not have extracted categories at their disposal; therefore, they apply purposive sampling – focusing on recruiting individuals who possess direct experience in the studied area. The quantitative tool allowed for rapid mapping of the opinions of a large group of experienced educators.

The results obtained in Stage I, in turn, become the starting point for theoretical (proper) sampling. The analysis of the collected questionnaires allows for the identification of "extreme cases" (e.g., individuals with outstanding technological enthusiasm or profound skepticism). It is precisely these results that indicate to the researcher whom to purposefully invite to Stage II (in-depth qualitative interviews) to test and develop the emerging conceptual categories. "Theoretical sampling consists of searching for appropriate data to develop an emerging theory. The main goal of theoretical sampling is to refine and improve the categories forming the theory" [1]. This iterative process of selecting successive individuals continues until theoretical saturation is reached – the moment when new data no longer brings anything new to the description of the phenomenon.

The target group was the cohort of teachers classified as the "digital immigrants" generation, acting in school communities as depositaries of pedagogical experience. 88 respondents participated in the quantitative phase of the pilot (initial sampling). This sample met the rigorous inclusion criterion, requiring the passing of the 49-year threshold. The subjects' age ranged from 51 to 79 years, while a significant analytical subpopulation comprised 59 educators who had turned 60.

Table 3. Age Groups

	50-59 years:	**60 years and over:**
Observations:	29;	59;
Mean Cognitive Component:	9.76;	7.95;
Mean Emotional Component:	8.14;	8.75;
Mean Behavioral Component:	9.83;	8.59;
Mean Overall Score:	27.72;	25.29;

Source: own elaboration

The analysis of professional indicators revealed that the studied group possesses an extremely rich professional workshop. The total length of pedagogical work experience of the respondents ranged from 11 to as many as 51 years of uninterrupted activity. Formal professional status correlates strongly with this, as the absolute majority of the sample was formed by teachers at the highest levels of professional promotion: appointed and chartered.

In terms of the profile of taught subjects, the group's structure reflected a comprehensive cross-section of the pedagogical council, which minimized the risk of bias associated with the specificity of a single discipline. The study included representatives of:

- mathematical, natural, and exact sciences (mathematics, physics, chemistry, biology, geography),
- humanities, social sciences, and languages (Polish language, history, civics, modern foreign languages),

- artistic subjects (fine arts),
- as well as a numerous group of educators conducting care classes and working as support teachers.

In the dimension of traditional digital competencies (ICT), the respondents declared varied activity – from using IT tools "a few times a week" to individuals using them sporadically ("once a week or less frequently").

Based on the data analysis for the group of 88 individuals, descriptive statistics for individual components and the overall attitude score are presented below:

Table 4 Descriptive statistics for the entire group of subjects (N=88)

	Mean:	SD:	Min:	Max:	Range:
Cognitive Component:	8.55;	1.84;	6.00;	12.00;	6.00
Emotional Component:	8.55;	1.38;	6.00;	11.00;	5.00
Behavioral Component:	9.00;	1.97;	6.00;	12.00;	6.00
Overall Score	26.09;	3.55;	20.00;	33.00;	13.00

(Source: Own elaboration)

The mean overall score (26.09) falls just below the theoretical midpoint of the scale (which is 27 points for 9 questions). This suggests that the attitude of the surveyed teachers is neutral with a slight shift toward skepticism. Teachers aged 50+ do not reject AI technology categorically, but neither do they exhibit uncritical enthusiasm toward it.

Component analysis: The dominance of action over emotions An interesting phenomenon is the comparison of the means of individual components:

- **Behavioral Component (9.00):** It is the highest and is located exactly at the neutral point. This means that despite their fears, teachers are most open to the practical layer – they declare a willingness to participate in training or test tools.

- **Cognitive and Emotional Components (8.55):** They are identical and slightly lower than the behavioral one. This suggests that the barrier to AI lies more in the realm of beliefs (e.g., lack of faith in the reliability of AI grading) and emotions (fear for competencies or students' critical thinking) than in an aversion to action itself.

The standard deviation values are relatively low (especially for the emotional component: 1.38). This attests to the high homogeneity (consistency) of the studied group. Teachers 50+ hold feelings and opinions that are very close to one another. The least variation occurs in the sphere of emotions – almost all subjects experience a similar mix of curiosity and anxiety. The lack of extreme attitudes is also worth emphasizing. The ranges of scores (e.g., 20–33 for the overall score with a theoretical range of 9–45) show that there are no "radicals" in the group. There are no individuals with an extremely negative attitude (scores close to 9), nor are there "technology apostles" with an extremely positive attitude (scores close to 45). All respondents fall into the "safe middle," which is fundamentally characteristic of groups with extensive professional experience, who approach novelties with distance but also pragmatism.

Discussion of Results and Conclusions

The obtained empirical data strongly resonate with the current scientific discourse. The cautious, even skeptical attitude of the oldest teachers (cognitive and emotional component) is not a manifestation of ignorance, but of a profound awareness of the challenges facing the contemporary school. As Więckiewicz-Modrzewska [13] observes, the implementation of language models such as ChatGPT gives rise to well-founded fears regarding the decline of critical thinking, analysis, and accurate inference skills among youth, often leading to intellectual dishonesty. This phenomenon, termed "algorithmic plagiarism" [4], as well as the widespread "hallucination" of fictitious facts by AI [4], compel teachers to deconstruct previous forms of knowledge verification. The solution to this problem is the transition to process-oriented assessment and the application of the "reverse engineering essay" method [4], which allows for examining the actual train of thought of the student, rather than just evaluating the generated product.

The skepticism of the 60+ group, however, collides with an urgent systemic need. Artificial intelligence tools are becoming an indispensable lifebuoy for Polish education. Assistants such as Google Workspace enable massive automation of burdensome bureaucracy – including generating Individual Educational and Therapeutic Programs (IPET) or detailed grading reports, which can save a teacher an average of 5–6 hours of work per week [4]. Unlocking this potential among "digital immigrants" requires strengthening their psychological competencies, especially digital resilience. As researched by Śluzek and Suppan [12], this resilience is absolutely crucial for overcoming technological difficulties and coping with the demands of remote and hybrid education. Building this resource prevents burnout and facilitates the maintenance of high work motivation.

A comforting prognostic is the highest score of the behavioral component, which proves that the older staff does not shun innovations *a priori* but needs wise support. It is precisely their rich life experience that makes the 50+ generation irreplaceable. Machines possess immense computational power, but they are characterized by a lack of capacity for feeling emotions, empathy, and adaptation to the individualized, psychological limitations of the student [13]. In the clash with information noise, the role of the mature teacher evolves toward an indispensable mentor and curator of truth. As Czarkowski and Czarkowski aptly point out (2026, p. 11): "AI will not take jobs away from teachers. AI will take jobs away from those teachers who will not want to use it." [4] For the machine will never replace direct, authentic contact and will not inspire the student with a life attitude.

The quantitative analysis based on the Attitudes Towards AI in Education Scale (SPAI-E), conducted on a group of 88 teachers aged 50+, allows for the formulation of certain empirical conclusions. The mean overall index in the surveyed population was 26.09 points (out of 45 possible), which places the sample slightly below the theoretical scale midpoint of 27 points (SPAI-E Scale, 2026). This value, with a relatively low standard deviation ($SD = 3.55$) and a range of 13 points (scores from 20 to 33 points), proves the high consistency of the studied group (SPAI-E Scale, 2026). It is worth emphasizing that no one in the studied sample achieved extreme scores. Senior teachers do not exhibit radical technophobia but adopt a neutral attitude tinged with pragmatic distance.

Significant intragenerational differences were revealed, where age itself constitutes a variable strongly differentiating attitudes. The subgroup of "younger seniors" (50–60 years) is characterized by a moderately open attitude (M = 27.72), whereas the older cohort, counting 59 educators over 60 years of age, presents a distinctly more conservative attitude (M = 25.29).

The internal structure of the attitude is particularly interesting. The cognitive and emotional components achieved an identical, merely moderate level (M = 8.55 for both subscales). The highest score in the behavioral component (M = 9.00), however, is a surprise. This means that despite evident gaps in theoretical knowledge and affective fears, the oldest educators exhibit relatively high readiness to undertake practical actions, such as testing new tools in the didactic process.

In conclusion, it is worth emphasizing that the results paint a picture of the 50+ teacher as a pragmatic individual. Although their internal beliefs and emotions are underpinned by a slight apprehension (scores < 9), in the sphere of declared actions they are ready to take up the challenge (score = 9), provided they receive appropriate support (e.g., dedicated training). The greatest challenge for this group is not a lack of willingness to work with technology, but barriers of a cognitive-emotional nature.

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