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Theoretical and Practical Aspects of "pure" Educational Technology Adapted to Support the Teacher's Activities

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The integration of educational technologies in education is frequently examined through case studies, often neglecting iterative and collaborative approaches such as participatory action research (PAR). This article presents an interdisciplinary pedagogical-informatics approach to designing personal educational software that supports and automates a wide range of teaching and research activities in real-world settings. By introducing the concept of virtual knowledge, the software works as a "cognitive translator", which enables teachers to manage their entire educational workflow—covering content creation, pedagogical tasks, file transfers, communication, and operations across networks, clouds, and institutional virtual learning environments. Unlike generic global technologies, which are often adapted for education but rely on vast, non-educational content and information, this technology is explicitly declared as "pure" educational technology. It is uniquely grounded in teachers' knowledge flows and is specifically designed to support pedagogical purposes and teaching activities. The article explores its pedagogical and technological benefits, demonstrating its practical applications in university teaching, including the development of innovative teaching methodologies and thematic educational materials. Finally, it discusses the CSU model of an endless knowledge-processing time loop for digitizing PAR, offering a theoretical framework developed through over 15 years of research.

Introduction

Integrating information technology (IT) into education poses a significant challenge for educators, designers, and researchers. Designing educational technology demands a unique interdisciplinary approach that synchronizes pedagogical principles and informatics to support teachers' activities effectively. However, even a cursory review of contemporary literature reveals that this demand for interdisciplinarity remains largely unmet. For instance, Sancho, Rivera-Vargas & Mino-Puigcercós (2020), argue that "a narrow vision of digital technology that ignores the complexity of education while wasting valuable public resources is becoming an obstacle to significant improvement and transformation of education".

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This gap has been widely criticized in recent academic discourse, with scholars highlighting the lack of theoretical frameworks (Oliver, 2011, 2013; Lundie, 2016; Laurillard, 2002 & Underwood, 2004) and the limited availability of dedicated educational software (Martens, 2014). Critical reviews such as (Kirkwood & Price, 2021) and numerous studies in technology-enhanced learning (TEL) have also underscored this deficiency(Walker, Swift, Ahmed, Jenkins & Vincent, 2016; Joseph, 2012; Kinchin, 2012; Stošic, 2015; Herwiana& Laili, 2022; Svetsky & Moravcik, 2019). Further valuable insights can be found (Goodman, 2002; Balacheff, Ludvigsen, Jong, Lazonder & Barnes, 2009; Roblyer & Doering, 2013; Bower, 2017), while efforts to bridge this gap can be seen in frameworks such as Technological Pedagogical Content Knowledge (TPACK) (Mishra & Koehler, 2006; Zhang & Tang, 2021; Lai, Wang & Huang, 2022). Early research in cybernetics approached the educational process as a system of knowledge transfer between teacher and student, mediated by feedback mechanisms (Klaus, 1962; Boros, 1976; Kotek, Vysoky & Zdrahal, 1990).

The interdisciplinary research presented here is grounded in the principles of participatory action research (PAR). Unlike traditional case studies, PAR methodology emphasizes iterative, real-world applications over hypothesis testing, focusing on practical outcomes rather than purely theoretical insights. While typical PAR studies in TEL often involve teachers selecting existing technologies for their classrooms (Goodman, 2002), the authors of this paper have pursued a different path: developing their own educational technology (software and IT infrastructure) since 2007-2008.

The key contribution of this research lies in its novel approach to solving interdisciplinarity in educational technology design. This was achieved through the development of virtual knowledge, a data structure that serves as a "personal cognitive interpreter." Virtual knowledge enables seamless educational knowledge transfer between humans and computers, allowing teachers and students to communicate with the system and each other through text, visuals, or audiovisual outputs. This innovation facilitates the creation of educational content, compilation of comprehensive teaching packages, and their application across various teaching modalities, including study materials, e-learning, and hybrid instruction (e.g., for blended and distance learning).

This paper is organized into three main sections. The first introduces the concept of "pure educational technology", which emphasizes the integration of IT into education by synchronizing pedagogical and technological aspects. It also explores theoretical approaches to educational technology and key educational frameworks such as Bloom's taxonomy and the TPACK framework.

The second section focuses on the basics of the Participatory Action Research (PAR) methodology for IT integration and the automation of teachers' activities. This includes a detailed explanation of the PAR framework, thematically divided into pedagogical aspects (teaching undergraduates) and informatics aspects (knowledge representation through virtual knowledge and knowledge tables). Additionally, it proposes the CSA model of the "endless loop" for iterative knowledge processing.

The third section presents examples of PAR outcomes categorized to support undergraduates, pre-service teachers, and collaborative research efforts. This includes pedagogical results (illustrated in screenshots) and the IT infrastructure comprising WPad, WPad BVI, and PIKS software, which represent innovative educational tools. The section also demonstrates the application of the CSA model using the example of exploring the *PER* journal archive via a navigation table created with WPad software.

Educational and Technological Aspects of Integrating IT into Education

General Educational Technology and the Concept of 'Pure' Educaional Technology

When considering the integration of IT into education, it is necessary to distinguish between general technology and educational technology. The term "general technology" typically encompasses a wide array of technologies used across different sectors and industries, whereas "educational technology" relates to technology in an educational context that is tailored to the needs and goals of teaching and learning. This includes not only digital technologies but also traditional tools such as chalkboards and textbooks. If one specified a search question using the term "digital educational technology", the answers would be: learning management systems, educational software, e-books and digital textbooks, collaboration (Microsoft 365) or assessment and feedback tools, and alike. Within the very context of this paper (development of own educational software), could be yet mentioned specialized software for subjects such as math, science, and language learning, and simulation software used in fields such as science and engineering. As for Wikipedia, educational technology is "the combined use of computer hardware, software, and educational theory and practice to facilitate learning". From this point of view, it is questionable whether it is justified to consider, for example, Facebook as an educational technology, which is paradoxically often declared as educational in case studies in scientific articles. In our case, a unique solution is presented, which we could describe as a "pure" educational technology, since the presented PAR research is based on the fact that both the computer and the teacher use the same knowledge, which allows for direct simulation of educational activities and knowledge-based processes. In other words, the described software functions as a cognitive translator and covers the "translation" of human knowledge into the computer and vice versa.

Theoretical Approaches to Educational Knowledge: Bloom's Taxonomy and the TPACK Framework

The concept of knowledge is central to education, philosophy, psychology, knowledge management, information science, and informatics, yet no universal definition exists. Intuitively, knowledge is understood as what resides in the human mind, but this simplistic view complicates the design of educational technologies and limits the development of tailor-made solutions. Consequently, teachers often rely on general-purpose technologies, testing their suitability for educational purposes and adapting to the constraints of these tools.

In terms of theoretical foundations, Bloom's taxonomy is widely referenced in educational research. The original taxonomy outlines categories of knowledge, including specifics, terminology, principles, and theories. The revised taxonomy reclassifies these into factual, conceptual, procedural, and metacognitive knowledge, each associated with cognitive processes such as remembering, understanding, applying, analyzing, evaluating, and creating (Hudecová, 2004).

Similarly, the TPACK framework highlights the intersection of technology, pedagogy, and content knowledge, adding a technological dimension to educational theory (Mishra & Koehler, 2006). Unlike Bloom's taxonomy, TPACK addresses the knowledge required for effective technology integration in teaching (Zhang & Tang, 2021; Lai, Wang & Huang, 2022). However, teachers' orientation toward TPACK often reflects either an educational or informatics perspective, though interdisciplinary approaches remain underexplored.

Both Bloom's taxonomy (or its revised version) and TPACK have been extensively studied and are relatively popular in pedagogical practice. Educators can choose strategies for applying them and determine whether knowledge will be presented as text, visual, audio-visual material, or a combination of these. However, a persistent challenge lies in the lack of a universal computer format. Teachers are often constrained by the capabilities of state-of-the-art technology, navigating multiple file formats and grappling with how to organize and display learning content effectively on screens.

This challenge is especially pronounced in STEM fields, such as chemistry, physics, and mathematics, where complex, multifunctional software is often needed. Computers frequently struggle to meet these requirements, forcing educators to combine digital tools with traditional methods like pencil-and-paper or chalk-and-blackboard approaches. Such obstacles—rarely discussed in detail in the literature—add to the complexity of implementing educational technology effectively (Svetsky, Moravcik, Tanuska, Rehakova & Ruskova, 2008).

This paper introduces in-house PAR software that supports the integration of these theoretical frameworks by structuring knowledge into "knowledge tables." These tables serve as containers processed by the computer, enabling the construction of ontological assemblies of e-learning materials and the design of complete curricula. This approach not only models knowledge dimensions as defined in Bloom's taxonomy but also facilitates cognitive process modeling, aiding educators in classifying learning objectives, designing activities, and assessing outcomes.

The authors propose virtual knowledge as a universal solution for modeling the TPACK framework, offering a theoretical and practical approach to integrate pedagogical and technological elements seamlessly (Svetsky, Moravcik, 2023).

Basics of PAR Research Desing for IT Integration and Automation of Teachers' Activities

Participatory Action Research Methodology

The authors' multi-year research in a university setting employs Participatory Action Research (PAR) as its foundational methodology. PAR is a research approach, but it's not typically used to test hypotheses in the way traditional scientific methods are. Instead, PAR emphasizes participation and action by members of communities affected by the research. PAR is a flexible, collaborative approach in which iterative actions, reflections, and refinements are conducted with active involvement from participants—teachers and students working in real-world educational contexts. Unlike conventional case studies that rely on hypothesis formulation, data collection, and analysis, PAR prioritizes the development and implementation of practical solutions through ongoing collaboration. As a cyclical process, PAR integrates planning, acting, observing, and reflecting, enabling researchers and participants to co-design solutions and adapt strategies in response to emerging needs. One distinctive feature of PAR-based research is its departure from traditional academic structures. Papers often organize sections differently, reflecting the iterative and cyclical nature of action and reflection inherent in the methodology. The focus remains on solving real-world problems and improving specific situations, with reflections informing subsequent cycles of action. This paper emphasizes the practical implementation of PAR in undergraduate teaching, pre-service teachers and academic research, illustrating how it adapts to evolving educational needs. Instead of focusing on quantitative or qualitative data analysis, it presents actionable examples that demonstrate how PAR facilitates effective collaboration and addresses real-world challenges in university education.

Pedagogical Aspects of PAR in Teaching Undergraduates

The integration of IT and educational technologies into teaching is inherently an interdisciplinary challenge. In the presented case, interdisciplinary research following the PAR methodology was conducted with the teacher's pedagogical activities continuously supported by the parallel development of WPad software. This software evolved step by step over many years, adapting to the everyday teaching and research needs of the teacher in undergraduate education and academic research.

The adoption of the PAR methodology in this context began around 2008, when literature suggested that PAR was effective in designing technology-enhanced learning environments for university teachers who select and test technologies for their teaching (Goodman, 2002). However, unlike most cases where existing technologies are tested, the added value of this research lies in developing custom educational technology tailored to the specific needs of teaching.

A significant outcome of this approach was evident in the modeling and digitalization of collaborative activities with students. It became clear that IT integration required, as a first step, the definition of pedagogical algorithms—well-structured sequences of teaching activities—and solutions for the audio-visualization of content to accommodate diverse learning styles. For example, the teacher had to carefully plan what content students would collaboratively produce, how it would be joined and shared in the faculty's virtual learning space, and how mixed text-audio-visual content could be generated using student computers to align with different learning styles.

Even today, this holds true: if a teacher does not have predefined pedagogical steps, those steps cannot be programmed into the educational software. This often leaves teachers dependent on random trials of general-purpose technologies to determine their suitability, which is inefficient and rarely meets their specific needs.

From this and the description so far, it should be clear why platforms such as Facebook, Office software (e.g., Microsoft Office), and other global technologies cannot be considered pure educational technologies. These tools lack defined knowledge structures and, therefore, cannot automate knowledge-based educational processes.

From an interdisciplinary research perspective, the essence of IT integration lies in addressing the core challenge: whether a teacher's knowledge and its transfer to students can be encoded into a format that computers can understand and process. This led to the conceptualization and implementation of *virtual knowledge*, which became the cornerstone of subsequent research. Its functionality and application will be explained in the following sections.

Informatics Aspects of PAR: Knowledge Representation - Virtual Knowledge and Knoweledge Tables

The cornerstone of this research is the construct of a *virtual unit of knowledge*, a conceptual model enabling knowledge representation that is comprehensible to both computers and humans. This approach has been recognized by the Slovak patent office, where a utility model based on this methodology has been registered (Svetsky& Moravcik, 2020). This representation, termed virtual knowledge, is composed of metainformation and content, where the metainformation serves to identify and contextualize the educational content (knowledge). Such a structure is fundamental for programming the automation of educational knowledge processes (Saadé, Rezai & Roschk, 2020).

From a technical perspective, virtual knowledge is implemented as a simple text-based database table. This format allows teachers, researchers, or students to input their tacit knowledge and educational content into a structured framework. The approach supports various educational settings, including face-to-face teaching, blended learning, self-study, and distance learning (Svetsky & Moravcik, 2014). At its core, a virtual knowledge table consists of columns dedicated to metainformation (e.g., month, topic, keywords, and links) and a column for the actual content, which can accommodate substantial volumes of text.

Figure 1 provides a visual example of how these tables are structured and utilized.

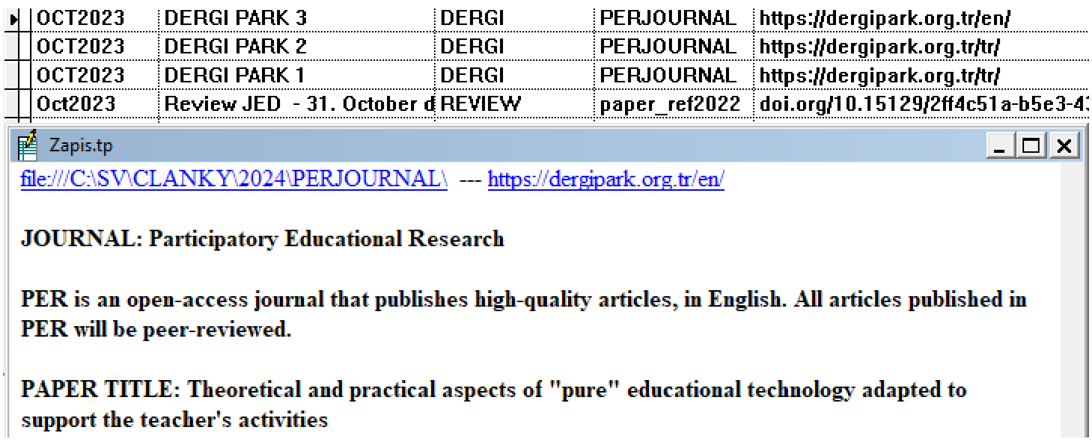

Figure 1. Screenshot: Inserting metainformation and content into a WPad Table

In the example shown, the teacher has populated the columns for metainformation in the upper window, including details such as the topic, keywords, and a link to an external resource (in this case, DergiPark). The lower window contains notes or educational content related to the specified topic.

The WPad software application—alongside its modified version, WPad BVI, designed for the blind and visually impaired—facilitates the creation, management, and sharing of such tables. From an informatics perspective, this tool enables users (teachers, students, researchers) to design their own tables as needed. These tables can serve as personalized information systems, study materials, e-learning content, or resources for self-study. Additionally, the software includes a feature to generate mirrored HTML tables, which can be uploaded to the faculty's virtual learning space for broader access (e.g., for blended and distance leraning). This allows teachers and students to independently organize and share knowledge while seamlessly integrating into academic workflows.

The IT infrastructure developed through PAR also led to the creation of an internet-based application, PIKS. This multi-functional tool supports blended and distance learning by enabling activities such as communication, information sharing, and collaboration. For instance, clicking on the Dergi Park image in the knowledge table (as shown in Fig. 3) directly opens the Dergi Park web page, demonstrating the seamless linkage between metainformation and its related content.

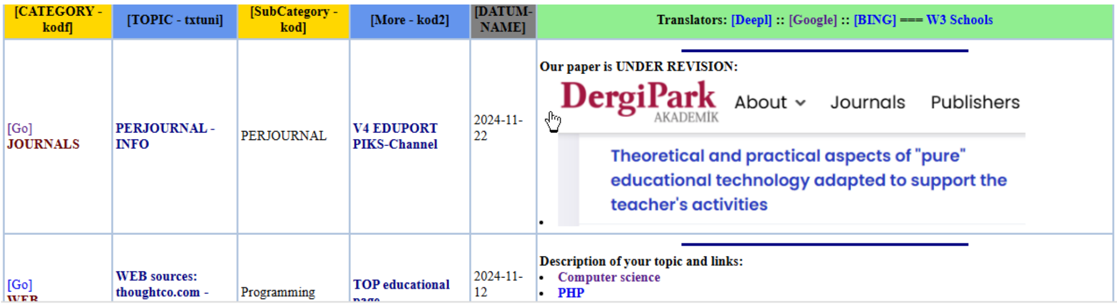

Figure 2: Screenshot from PIKS application providing information about Dergi Park

This educational WPad software empowers teachers and students to efficiently process large volumes of educational content stored on their computers. It acts as a navigation tool, seamlessly connecting users to hundreds of files on their devices or to the university's academic information system. By integrating virtual knowledge into teaching through knowledge tables, WPad offers a scalable, flexible, and efficient method for organizing and managing educational content across multiple formats. This approach exemplifies a significant advance in automating educational processes and aligns well with the interdisciplinary goals of the PAR methodology, enabling the generation of diverse research outputs.

a) Example of PAR Results 1: Tool for Teaching Programming Languages

WPad facilitates the teaching and learning of programming by storing programming snippets in individual rows of a knowledge table. These tables serve as repositories for programming code, accessible to both teachers and students. During undergraduate programming courses, students populated their personal tables with source code in languages like C++, which they later shared via the faculty's web learning space.

b) Example of PAR Results 2: Tool for Content Repositories and Hybrid Sharing

WPad supports the creation and management of content repositories by allowing users to input teaching and study materials into knowledge tables. These tables can be exported as common file formats, making it easy to store and share content. This capability fosters collaboration among students and teachers, significantly enriching the learning experience.

New PAR Technology Paradigm Based on Model of CSU Endless Time Loop

Many years of developing the presented iterative PAR to support a teacher resulted in the design of pure educational technology. It enabled a large number of solutions to be implemented to university teaching and research. In this context, nowadays, a theoretical generalization was formulated based on finding that IT integration in education should be solved in time during it educational knowledge is processed within the endless Create–Select–Use (CSU) loop in which technology operatively enters. Figure 3 depicts the endless CSU loop concept for knowledge processing over time and how it is related to educational technology. Based on this, a new interdisciplinary paradigm of synchronizing technology and teaching began to be developed, an example of which is presented in the following text.

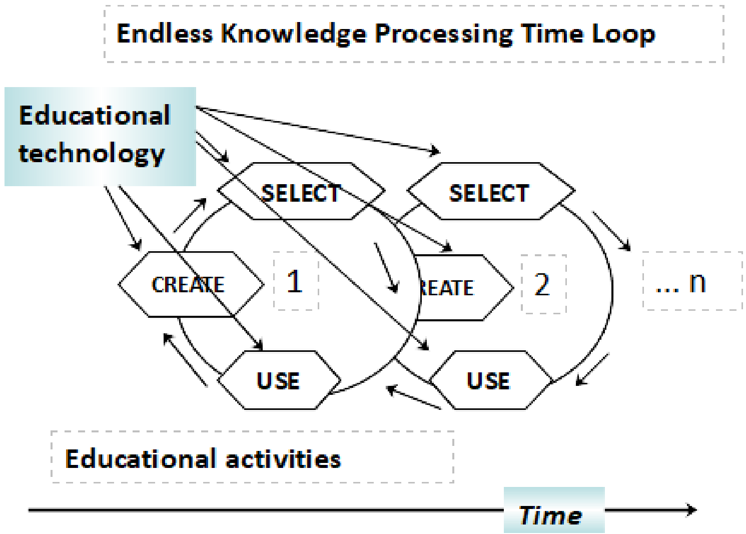

Figure 3. CSU endless time loop for integration of digital technology into education

Examples of PAR Results Categories to Support Undergraduates, Pre-service Teachers, and Research

PAR to Support Collaborative Activities of Undergraduates

The PAR research methodology was also applied in undergraduate teaching across several study courses requiring a multi-thematic approach. One example is the course *Basics of Industrial Environmental Protection*. Figure 4 illustrates the flow of knowledge from various thematic areas during a single teaching hour. The scheme highlights the significant role of the time factor, as the teacher must address multiple types of educational content—such as Biology, Biochemistry, Mathematics, and Physics—during teaching hours, i.e., within a constrained timeframe of approximately 50 minutes. While high-quality pedagogical videos are available to support instruction, their use during teaching hours is often impractical due to these time constraints.

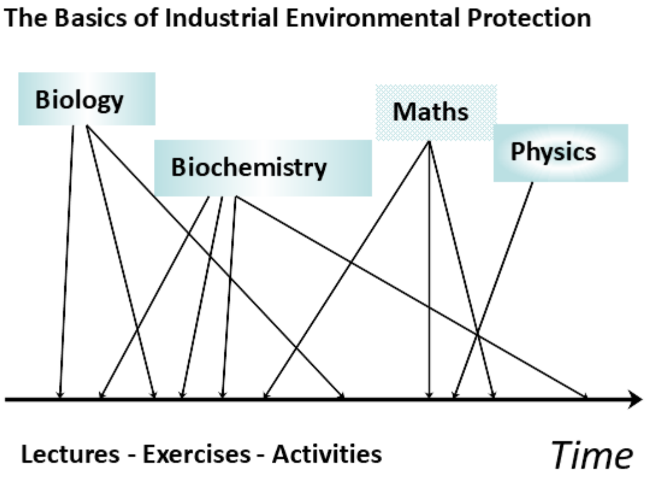

Figure 4. Scheme showing the flow of knowledge (educational content) when teaching undergraduates

While the previous section outlined theoretical approaches to knowledge, this section focuses on how the flow of knowledge during undergraduate teaching was facilitated using the WPad software and its knowledge tables. Developed iteratively over approximately ten years, the WPad software has supported eight study courses, ten diploma theses, publications, and research projects. It also facilitates various teaching tasks, including formative and summative assessment. The iterative nature of its development reflects an ongoing process of refining programming codes to address real-world teaching activities.

Another example of WPad application in PAR is a study course titled *Semester Project*. At the beginning of the semester, the teacher collaboratively developed a sample project to serve as a model for students to create their individual projects. A standard classroom setup was used, consisting of 10 computers with the WPad application installed. Each student pair worked using their individual knowledge table, where they documented the manuscript for their semester project. By the end of the semester, they had a complete transcript, which they then copied into a Word editor for finalization. This setup supported two student groups of 14 and 15 undergraduates, respectively. Throughout the semester, the WPad software enabled students to continuously add content to their tables. The teacher could monitor their progress at any time, offering feedback and guidance as needed. This process is illustrated in Figure 5, which depicts a shared WPad/HTML table that served as a detailed manual for writing the semester project. The table provided step-by-step instructions, such as how to write an abstract, cite sources, take notes during exercises, and retrieve information effectively.

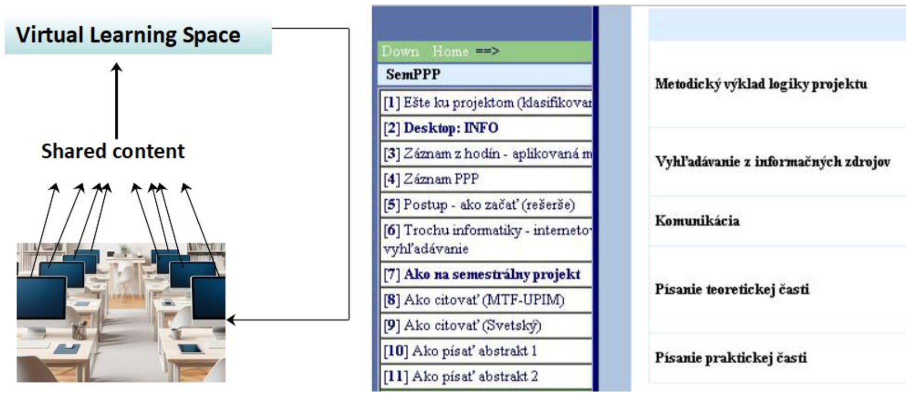

Figure 5. Scheme for collaborative writing of the semester project in the classroom (left) using instructions for this process on a web page (right)

The use of individual WPad and HTML tables by students provided significant pedagogical value. It was observed that many students had substantial deficiencies in fundamental chemistry concepts from their prior schooling. To address this, the teacher assigned a task where students used the WPad menu to search for essential topics online, such as the periodic table and chemical laws. Each student was required to research their assigned topic, extract relevant information (e.g., from sources like Wikipedia), and enter it into their individual WPad table. Subsequently, all the students' tables were compiled into a single pdf file and uploaded to the faculty's virtual learning space. This collaborative approach allowed the students to collectively create a body of self-study material, which was later used by students in the following academic year. While the material may not have been didactically perfect, it effectively served its purpose, enhancing both learning and resource-sharing among students.

PAR to Support Pre-Service Teachers (Diploma Works)

Similarly to how undergraduate study courses were supported, several diploma theses by pre-service teachers were also facilitated within the PAR research framework. The faculty's pedagogical institute allowed students to choose thesis topics centered on creating e-learning content, which served as a testing ground for the WPad application as a tool for e-learning development. This iterative PAR approach led to updates in the WPad system, including the addition of new source codes to enhance its functionality.

By modeling e-learning content as part of their diploma work, pre-service teachers demonstrated how pedagogical activities could drive innovation in educational technology. This practical application highlighted the value of integrating such tools into teaching practices. Figure 6 illustrates e-learning outputs developed by the students, showcasing topics like thread production and lapping technology (finishing).

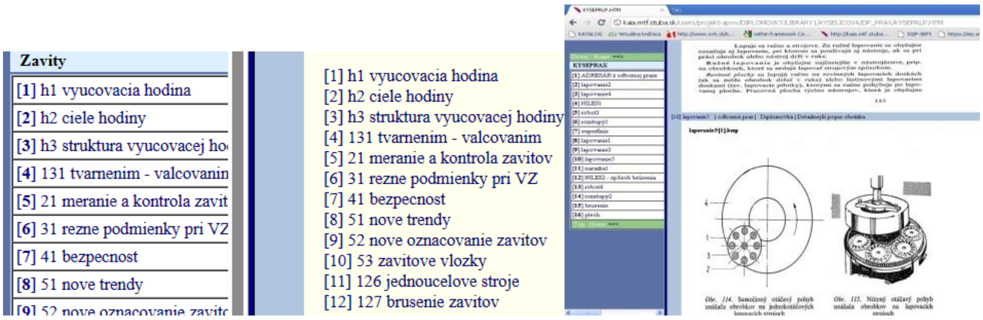

Figure 6. Screenshots of e-learning materials created by pre-service teachers, featuring content on thread production (left) and lapping technology (right)

PAR to Pilot Innovation in Supporting Collaborative Modeling of New Teaching Methodologies

The iterative evolution of the presented pure educational technology, designed primarily to support teaching activities, can be illustrated through the development of PIKS communication/information/chat channels. PIKS, an internet application derived from a simplified version of the WPad software, emerged from the need to connect classroom activities with the faculty's web pages for courses. As a Personal Information and Knowledge System, this multipurpose application allows users to view or insert content, chat, and upload or download files.

To date, several personalized PIKS channels have been developed. For instance, one channel is currently being tested in a project that connects teachers from five countries, including blind and visually impaired (BVI) users. The core functionality of this approach involves the teacher uploading task instructions to the PIKS channel, which students can then download. Students complete the tasks and upload their responses as PDF files to the same channel. The teacher, equipped with a dedicated .exe file, can automatically generate a table where each row corresponds to a student, containing links to their submitted PDF files. This streamlined process eliminates the need for complex virtual classroom systems or global software, allowing teachers to manage distance education autonomously and efficiently.

Figure 7 illustrates the key steps of this process schematically.

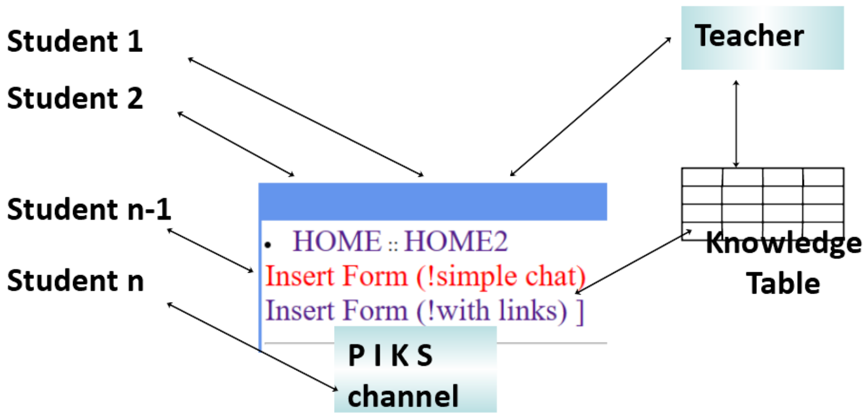

Figure 7. Model of teaching students using a PIKS channel

The integration of the WPad/WPad BVI desktop application with PIKS channels significantly enhances the efficiency of a teacher's workflow by automating educational activities and accelerating the flow of information to the computer. This level of automation is increasingly critical in today’s educational environment, as it supports multitasking—allowing teachers to switch seamlessly between different types of content—while maintaining a primary focus on entering selected educational material into WPad tables. By working with specific, curated content rather than computer files, this approach effectively reduces the risk of information overload for teachers (Serfaty, 2016; Mark, 2015).

Another example of a PAR pilot activity involves applying the batch knowledge processing method to support teachers in handling large volumes of educational content efficiently. Figure 8 illustrates one such case, demonstrating the development of the "endless CSU loop paradigm" above-mentioned within the PAR framework. In this scenario, a teacher can generate a navigation table from a library archive using the WPad menu, which connects directly to Volume 1, Issue 1 of the PER journal archive. The resulting table contains 14 rows, and if the teacher possesses basic informatics skills, they can extend this process to create navigation tables spanning multiple years. Teachers can then refine these tables to select only the materials relevant to their needs, or even embed entire papers into the table for easier access. For example, using this method, the authors examined some years of the PER archive but did not find any approach comparable to the one presented in this paper.

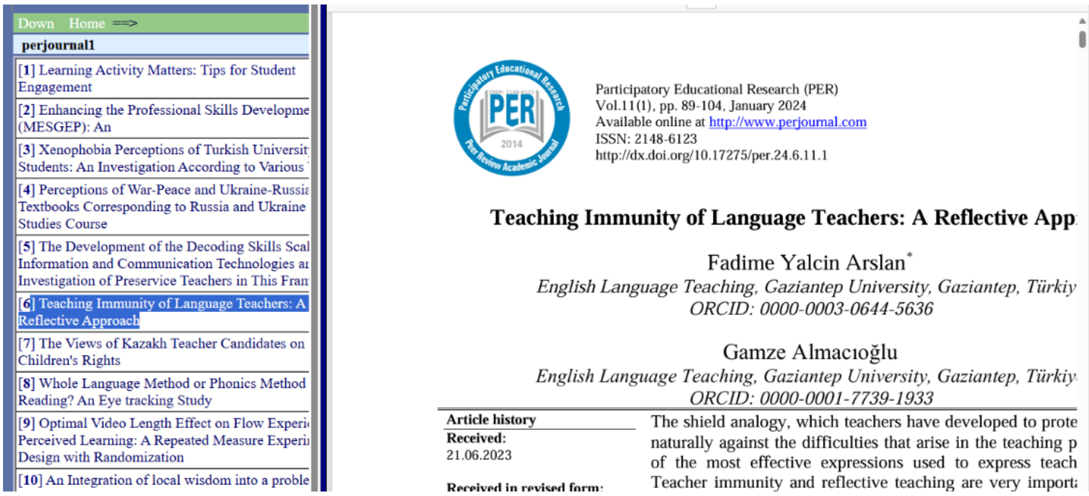

Figure 8. Sreenshot from design of CSU-Model Paradigm (Exploring Perjournal)

Discussion

The term educational technology inherently underscores its interdisciplinary nature. This suggests that any research on integrating IT into teaching, learning, and academic research must operate on two parallel levels: pedagogical and informatics. Within this paper, the educational and technological aspects of the presented PAR methodology were discussed in tandem, addressing both pedagogical research results (illustrated in several figures) and informatics research results (i.e., IT infrastructure involving WPad, WPad BVI, and PIKS's proprietary software). The WPad, WPad BVI, and PIKS systems also integrate key principles from instructional design theories, broadening their applicability to diverse educational settings. For instance, Gagné's Nine Events of Instruction provide a structured approach to designing effective learning experiences by focusing on stages such as gaining attention, presenting content, and providing feedback (Gagné, 1985). By incorporating these stages, WPad and its variants ensure that learning materials are delivered systematically, enhancing knowledge retention for both visually impaired and non-BVI learners. These educational tools enable automatic feedback, intelligent tutoring, and personalization, providing robust support for teachers. They also allow educators to design language teaching tools similar to those presented by Weng and Chiu (2023) in their work on Intelligent Computer-Assisted Language Learning environments.

Unlike a single-purpose case study, the PAR methodology adopts an iterative approach. It begins with foundational teaching practices for undergraduates and pre-service teachers and evolves into contemporary research, such as the CSA model and collaborative investigations of new teaching methodologies. Each academic year presents unique pedagogical challenges, prompting the development of tailor-made programming codes to synchronize teaching needs with IT educational tools for teachers. Practically, this approach allows teachers, students, and researchers to interact with computers using only the simple tables. These tables serve as a shared data structure where users input educational content, such as notes, instructions, evidence, and various types of texts. The computer interprets this information as a new form of knowledge representation, utilizing WPad software to manage and process it.

Moreover, the database tables with educational content function as hybrid navigation tools that can be seamlessly transferred between online and offline environments or stored to USB keys. This dynamic capability supports diverse teaching modes, including classroom instruction, blended learning, and distance education. By leveraging WPad software and WPad/HTML tables, teachers gain a powerful personal educational tool that adapts to various teaching contexts, as illustrated in Figure 4.

Notably, the presented system enables teachers to generate educational content and instructions in real time during lessons, for self-study, or within a short timeframe for purposes such as creating HTML tables for e-learning. This flexibility underscores the practical value of the PAR methodology in enhancing teaching effectiveness and streamlining educational workflows. The presented iterativity of PAR time milestones should enable a better understanding of the proposed concept of the "pure" educational technology based on programming new codes for each new pedagogical situation in teaching. In paradox, mostly papers published e.g. by Springer, Taylor&Francis, Wiley are focused only on exploring the impact of existing technology on learning outcomes or various learning issues, which are not derived from educational knowledge flow in real practice of teaching (in comparison with PAR, any individual case study methodology cannot cover over 15 years PAR research). In contrast to generic technologies, the authors of this article presented the design of educational technology primarily derived from teacher activities. This approach enables educators to use these tools for practical modeling of frameworks such as Bloom's taxonomy (Gogus, 2012; Hudecová, 2004), TPACK (Mishra & Koehler, 2006; Zhang & Tang, 2021; Lai et al., 2022), or for integrating technology as an added value within the pedagogical PAR methodology (Goodman, 2002).

That is why the authors propose the term "pure" educational technology, which means only technology that is designed synchronously with a specific pedagogical situation. However, the added value to the scientific literature lies not only in the use of technological PAR but also in the orientation towards the teacher's technological support as a key person in education and the concentration of educational content into knowledge tables such as WPad/HTML/PIKS. The literature does not specifically describe a similar WPad BVI modification for blind and visually impaired users.

The presented PAR support system enables teachers and students to create e-learning and study materials that combine texts, images, audio, and video outputs. It aligns with established learning style theories, such as Kolb’s experiential learning theory and learning styles model (Kolb, 1984; Kolb & Kolb, 2013; Felder, 2002). These theories, as discussed by Dantas and Cunha (2020), advocate for integrating learning style approaches to enhance the learning process. The educational software WPad or WPad BVI also serves as a learning style tool, similar to Protus, an adaptive learning system developed by Marosan, Savic, Klasnja-Milicevic, Ivanovic, and Vesin (2022).

Conclusion

This paper advances the concept of “pure” educational technology—technology intrinsically linked to teachers' knowledge flows and distinct from global, generic solutions. It emphasizes interdisciplinary educator support by introducing a theoretical educational model and practical IT tools aligned with participatory action research (PAR). Through practical examples, it illustrates IT integration in undergraduate teaching and academic research, showcasing a teacher-focused IT support system functioning as a “cognitive translator“. Grounded in frameworks like Bloom's taxonomy and TPACK, this system enables knowledge flow processing in diverse educational settings, including e-learning, blended learning, adaptive learning, and collaborative methodology design within a university's virtual learning space.

The PAR methodology presents a unique contribution to educational technology by synchronizing pedagogical research with the iterative design of innovative tools. Unlike traditional studies that assess the impact of existing technology, this approach offers a utility model centered on virtual knowledge representation. Over 15 years, it has led to the development of tailored tools such as WPad, WPad BVI, and PIKS, addressing pedagogical needs while filling a critical gap: the automation and mass-processing of human knowledge to alleviate information overload. The framework provides scalable, practical solutions for teachers navigating complex knowledge flows.

This work is pioneering in its synchronization of technology design with real pedagogical challenges, shifting from the mere evaluation of technology's impact to fostering teacher-driven innovation. By directly addressing teaching and learning processes, it demonstrates broader applicability and potential for transformative impact in education. Finally, by presenting actionable insights into the development of pure educational technology, this paper fills a significant gap in existing educational tools for collaborative PAR methodologies. Future research will refine the interdisciplinary pedagogical and informatics support model of the CSU endles loop cycle (Create-Select-Use), further strengthening the conceptual and practical foundation of the pure educational technology.

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