The Universal IT Support Design for Engineering Education

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***Abstract*—In terms of integrating IT into teaching, current technologies do not provide a universal solution for teachers' personal support and have a shorter lifespan than teachers and educational processes need. As a result, technology does not adapt to a wide range of teaching activities, but teachers have to adapt to technology. The paper presents such a universal solution based on the authors' interdisciplinary approach to solving IT integration into university teaching and learning, self-study, publishing, research and all kind of personal activities performed by a teacher, including appropriate activities of students. It is based on the development of own in-house universal IT system (application software and combined offline / online infrastructure), which can be used for any category of engineering STEM teaching. The uniqueness of the solution is based on the design of the so-called virtual knowledge into which it is possible to insert in a suitable way concentrated educational content in the form of texts, images, audio and computer files. From the virtual knowledge, educational tables are created using WPad educational software, which allows simultaneous generation into html-format and placement on the faculty or WEB. The paper describes its use and how it works on the IT infrastructure developed for the integration of IT in teaching. The automation of the teacher's work (including visually impaired) on the creation of educational packages is also described, which will also be the subject of further research.**

Keywords—*technology-enhanced learning, educational software, educational content, virtual knowledge*

I. Introduction

At present, every teacher is burdened with a huge amount of information in practice, which also applies to the creation of teaching content, because they must not only select the appropriate knowledge, but also create quality pedagogical content and teach within a limited time limit given by the length of lectures and exercise. And since state-of-art, despite the enormous progress of computer technology, does not provide suitable IT tools for mass processing of information and thus extensive educational content, the authors began to address this issue in the 7th Framework Program for technology-enhanced learning. As part of the empirical research, the primary goal was to develop all-in-one software that allows individuals with low IT skills to collectively process educational content that also uses Internet resources, which was installed in the classroom with computers as part of teaching undergraduates. Mastering this goal has made it possible to start working on the automation of knowledge-based processes, which also include teaching and learning. So other goals were to program communication channels so that teachers and students could exchange, inform, instruct, and communicate with each other. All this could be managed only thanks to the design of virtual knowledge as a specific database structure (it is registered with the patent office within the utility model). So, another and at the same time current and future goal is to apply this structure to the creation and transfer of educational content in any educational processes, including such as assessment and various administrative activities.

Jednotlivé sekcie to prbližujú

II. Conceptual Framework

The solution of IT integration into teaching and learning is based on the fact that it is a set of knowledge-based processes, which from a pedagogical point of view are represented by specific didactic/pedagogical algorithms. In real life, there is a very diverse range of the algorithms, which are different in engineering teaching, different in humanities and, for example, completely different in visually impaired teaching. This logic requires writing tailor-made computer/informatics algorithms for each individual case. In this context, there is no universal computer software on the market that is particularly suitable for supporting teachers or students as individuals. As a result, teachers must use existing software and technologies, test their suitability, and adapt. Ordinary teachers are not aware of these things, but computer experts simply explain that the computer as a machine lacks knowledge representation. And this is compounded by the problem that the terms information and knowledge have different meanings in different scientific disciplines.

A. Principle of educational software development

The authors managed to solve these contradictions precisely by designing virtual knowledge, which one sees in a common tabular form. An individual can put tacit knowledge into it in his natural language, while for a computer it is just some computer object that can process extremely quickly. In this case, the cybernetic principle is implemented, ie virtual knowledge functions on the morphological principle as a switch between the mental processes of man and the physical processes of the machine. And because the machine works extremely fast, it can deliver the necessary output to the person (teacher) almost immediately and thus automate his activities.

The WPad software, written by one of the authors of this article, has been evolving over the years on the principle that source code must always simulate some educational activity, ie not only work on the creation of learning content but also its transmission. The progress of software applications for the automation of educational processes has been continuously published by the authors in recent years depending on what new functions have been added to the user menu. Mastering the creation and use of content in the teaching of undergraduates required solving how to integrate this content into activities connecting teachers with students, ie how to select content from the knowledge base (for example from the

created virtual learning space on the faculty server) and use it directly in lectures and exercise. So, communication channels passing through the classroom with the online environment were programmed as an Internet application (they were used to exchange information even for testing). All this allowed for a progressive approach and an awareness of the fact that any IT integration requires the synchronization of pedagogical and IT algorithms and software must be designed to be compatible with Windows, computer networks and clouds (in other words, they must run on a specific IT infrastructure). The creation of a software system and IT infrastructure has taken research to a higher level, when the vision of the functioning of virtual knowledge as an intelligent educational structure is already beginning to be realized. This developed approach will be presented in the article, for example, on the automatic creation of educational-packages (as knowledge-packaged categories) with special emphasis on applications for visually impaired education.

B. Software adaptation for teaching undergraduates

It should be emphasized here that WPad has evolved over the years according to what has been required to teach in the classroom with undergraduates in order to create them quality teaching material for exercises and lectures and self-study in the virtual educational space of the faculty. The user menu gradually grew to hundreds of items, and suddenly it became clear that there was no similar software on the market - just because students and teachers could switch between the Internet and folders and files on their computers from the same WPad spreadsheet environment. Also the highlights were that the number of clicks decreased. And the biggest advantage for a teacher, graduate or doctoral student who designs some educational content was that they use WPad as their Notebook. And using the CTRL-F1 keyboard shortcut, a mirror html page of the WPad table is created. Thus, eLearning scripts for several subjects were then created from individual tables and placed on the faculty server so that students could access from home or classroom. In other words, WPad works not only as a simple text editor but also as a simple html-editor (the user does not need to know the html codes or the program for creating WEB pages).

It can also be noted that WPad originally began to develop in industrial R&D research at a time when the Internet was not yet commonplace. In the testing laboratory, the program and tables were also used as an information system for the ISO 9001 quality standard. It was interesting that in the offline mode, ie without internet access, the Opera browser was used. Ordinary users do not know that browsers can also be used offline, i. on a personal computer. Here, it is especially convenient to use IExplorer or Edge browsers, which switch to Windows Explorer, which users are used to (after other browsers do not allow this), after entering the offline path on the computer.

In addition to mastering the mass creation of teaching content, it was necessary to program communication channels. We could call them chat-html-sites in which students could communicate with each other and with the teacher, who gave them instructions, tasks, teaching content.

The problem at the time was that the students did not know what to communicate and what to write in the communication channels. So the teacher had to give them instructions (eg write the name of the semester work, your names and identification data). In practice, this means that the teacher or student can have their own communication paths. Although communication channels were introduced into teaching about ten years ago, the current state of technology allows them to be better used. Scrrenshot in FIG. 1 illustrates the current use of the PIKS (Personal Information and Knowledge System) communication channel, which functions as an additional Internet application with the same structure as WPad (just the contents of the tables are on a database server with MariaDB).

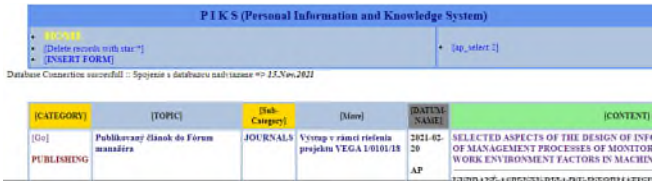

Fig. 1

C. Comparison of WPad software with other solutions

Although the articles of all the well-known scientific publishers (Springer, Wiley, Science Direct, Emerald) were examined, no software was found that would allow to cover so many educational activities together. Or it allowed activities that other software did not allow at the time - e.g. the English teacher entered the sentences into a WPad spreadsheet, generated an html page, and after clicking on the sentences, a computer from the American server I am Translator spoke to them (around 2007, TTS technology was not as common as translators allow today).

The result of the back-analysis was that the software works as an all-in-one system due to the specific data structure of the table. Based on this, a utility model was submitted and later successfully registered as a technical solution. It uses this specific structure not only for content creation but also for the transfer of tables within an off-line or off-line and on-line environment [UV 7340]. In the following research, the software was also installed and tested on a faculty virtual machine. This allows tables to be transferred between a server with a virtual machine and a computer that has the same WPad software installed.

It should also be emphasized that if the tables contain manually entered notes or copied selected text, then WPad actually acts as a tacit knowledge converter (the term tacit knowledge is used in Knowledge management). From a practical point of view, the advantage was that the students used the installed WPad, so the content could be collected and combined from their computers and the teacher could more easily evaluate and use them for collaborative activities. For example, undergraduates had insufficient knowledge of chemistry, which required teaching the subject Background of environmental protection (in industry). So each student was given a task in the WPad spreadsheet to do an Internet search on topics such as oxidation, reduction, pH, amino acids, etc. and make an internet multi-search with WPad (multi means that how many words are written to the table as many windows search engine opens).

The registration of a utility model has opened up a new phase of endless possibilities for processing knowledge (didactic content in tables) and information (general content in computer files). I assume that from the previous description there should be a clear difference between the WPad table with the selected reduced content and computer text files (pdf. doc, txt, html), which contain unreduced content. This difference is more difficult to explain to an educator than to an IT professional, because in the IT field, the WPad function is

understood as knowledge management, while working with files as information management (the BOX cloud service refers to this as content management).

It is important to understand that no common software allows, as in the case of WPad, the concentration of offline and online content by processing knowledge and files in virtual knowledge tables, as well as the generation of html outputs. This also made it possible to start developing application menus and various sophisticated activities. Application menu means creating menu items that combine several simple menu items into one sequence and perform them with a single click. In other words, from the point of view of the teacher and the user, it works like a black box.

III. Actual or Anticipated Outcomes

As follows from the previous explanation of the approach, IT integration into education is a very complex matter because it is an interdisciplinary area and in our case a completely new technology is being developed within academic engineering education and research. The main output is therefore a universal IT system that can be applied to any activity of teachers, students or individuals and simulate educational processes as knowledge-based. Its theoretical basis is the above-mentioned virtual knowledge that governs the software being developed within a particular IT infrastructure. This functionally enables the switching of teachers 'and students' computers with online environments, university LMS systems and Internet services, ie also within any category of teaching, e.g. blended learning, distance learning, assessment. Outcomes from many years of research enabled personal IT support within the teaching of study courses (eg, Background of environmental protection, chemistry, Occupational health and safety, Programming languages, Simulation modeling,…) and research (FP7 - Technology enhanced learning, Digital libraries, Learning analytics, Horizon - Cracking language barriers, V4 project -CSCL). As mentioned, the portfolio of pedagogical / didactic algorithms in real life is so huge that no artificial intelligence can do it. The presented IT support system can now be used to continue the elaborated outputs of the automatic creation of educational packages, language support for publishing and the solution of IT support for visually impaired education. In this context, it should be mentioned that on the basis of preliminary tests, the educational software can to some extent also be used for the blind, which will be addressed in this article in the sections from previous applications. Within the IT support design for engineering education, the outputs can be divided into the following items of the developed IT system:

IT integration SYSTEM = SOFTWARE + HARDWARE + IT INFRASTRUCTURE

SOFTWARE: 1. WPad - educational software 2. PIKS - communication channels 3. A set of exe-tutorials or

HARDWARE 1. Client computers with Windows 2. Notebooks with Windows 3. Mobile phones (for Virtual learning space browsing) 4. E-Sources - USB, CD, DVD

EXTERNAL INFRASTRUCTURE (personal or faculty's IT equipmment or Cloud-secvices)

1. Virtual Machines with Windows (for WPad) 2. Learning WEB-space (for FTP transmission and PIKS)

IV. Conclusion/Recommandation/Summary

The paper presented an interdisciplinary IT support design for engineering education, which is implemented in engineering education and is especially suitable for STEM teaching. Namely, virtual knowledge enables work with texts, images, computer files and thus also visualize educational content and activities, which is primarily in STEM, in contrast to managerial and humanities subjects, where text is used more. It has been explained that universality is given by the concept of virtual knowledge, which the computer understands as a representation of knowledge (as a kind of information - because the computer does not work with knowledge but information in the form of bytes). As part of a long-term solution of IT integration into teaching, a personal support system has been developed that can be used primarily by the teacher as an educational IT tool for any activity he / she performs (teaching, creating eLearning, research, publishing) and which can serve as an educational tool for his students. The paper presents examples from the creation of educational packages and support for visually impaired education and the vision is to continue programming with a vision of an intelligent educational structure. In terms of limits, it should be emphasized that IT integration is interdisciplinary and consists not only of pedagogical algorithm design and parallel design (didactic algorithms must be defined, otherwise they can not be programmed), but the most difficult thing is programming adaptation on Windows, networks and clouds, which is time the most demanding. It should be mentioned that this is a research of technology that has not existed before and its basic thesis is to solve a prototype of how thousands of educational activities can be simulated. The authors surprisingly encounter misunderstandings on the part of teachers, or even pedagogical journals, who do not accept this phase of research. In other words, they only recognize if some students work without a computer and part with a computer to test some hypothesis. From this point of view presented new technology, educational software can be used e.g. In Humanities PRE * POST Academic Research. Logically, however, they could not do it if there was no research to develop and supply this technology.

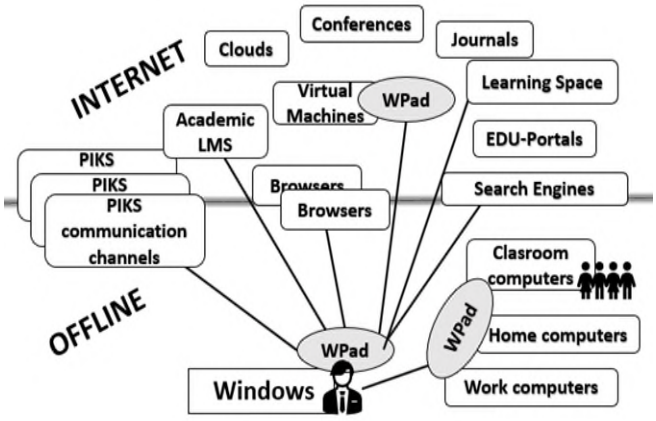

Fig. 1 Teachers personal IT infrastructure

V. Actual or Anticipated Outcomes

Základom práce na osobnom počítači je používanie priečinkov a počítačových súborov v offline režime, kedy žívateľ využíva prístup k nim Windows Explorer. Pore prácu

na internete využíva ako prpínač prhliadače, ako sú IE, Edge, Chrome, Firefox, Opera, Safari a pod. V tomto prípade ide o zložité softvéry, ktoré majú zakomponované v sebe nespočetné množstvo funkcií. Prakticky to znamená, že užívateľ ho môže využívať na sinternet search, zapisovať do horného riadku cesty, môže si vytvoriť systém linkov na stránky na ktoré chodí pravidelne a podobne. Pri práci s operačným systémom Windows Tento spôsob práce ilustruje ľavá časť Fig. 2. V pravej časti je ukážka využitia softvéru WPad, z ktorej vidieť, že učiteľ môže Eplorer aj prehliadač obísť a priamo z tabuliek WPad otvárať súbory, priečinky alebo internetové stránky. To unožňuje ušetriť obrovské množstvi klikaní medzi jednotlivými offline a online prostrediami, takže jednotlivec pri používaní WPad ušetrí tisícky až desaťtisícku klikaní myšou ročne. Učiteľ si tak môže vytvoriť vlastný systém a automatizovať svoje činnosti napríklad vytváraním si množíny favorites vo svojich tabuľkách.

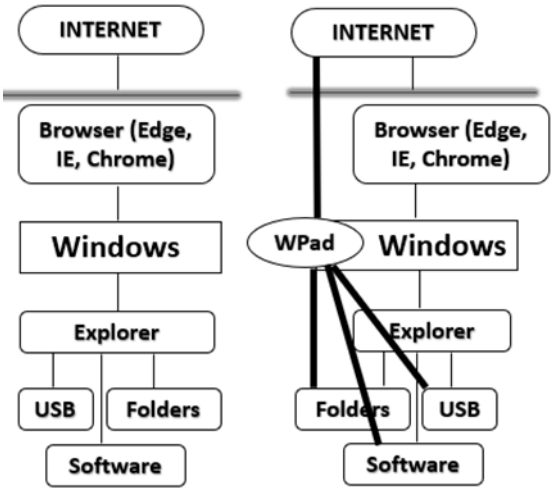

Fig. 2

Tu treba zdôrazniť, že Wpad sa vyvíija roky primárne za účelom automatizácie akýchkoľvek činností učiteľa, ktoré sa dajú rozdeliť na tvorbu obsahu, podporu prednášok a cvičení, publikovania, výskumu ale aj jeho samoštúdia a ostatné činností súvisiace s jeho prácou, vrátane administratívy. Takže tvorba množín favorites je len jednou z aplikačných možností využitia výstupov výskumu integrácie IT do výučby a riešenia adaptácie učiteľa na operačný systém Windows a vybudovanú kombinovanú offline/online infraštruktúrIT ifraštruktúru (softvér, virtuálny stroj, WEB-priestor s funkciou vVirtual learning space/environment, komunikačné kanály). Princíp automatizácie je veľmi jednoduchý, t.j. ak učiteľ niečo často robí s počítačom, napíše s ana to zdrojový kód a dá do užívateľského menu programu WPad.

Súčasne je príkladom, že súčasťou adaptácie uťčiteľa na technológie je, že aj učiteľ sa musí prispôsobiť tak, aby využil všetky jej možnosti. A tiež treba zdôrazniť, že učiteľ si musí vytvoriť aj vlastné didakticko-informatické algoritmy, aby prácu počítaču aj uľahčil. Pritom nejde len o organizáciu priečinkov a pod., ale aj to, že si si vytvorí vlastný spôsob práce využívaním softvéru WPad a knowledge tables.

Ako praktický príklad využitia schém na Fig. 1 a Fig. 2 možno uviesť, príklad z výučby undergraduates, kde učiteľ učil niekoľko študijných kurzov a na všetky potrebné data mal k dispozícii univerzitný LMS - Academic informatic system (AIS). Už na hlavmo vstupe do AIS je aj stovka linkov rôznych kategórií. Z nich učiteľ okrem interného univerzitného mailu najčastejši využíva svoj priestor a priestor študentov, kde nájde všetky mená, krúžky, kde môže zapisovať aj známky a pod. V danom prípade edukačný softvér WPad umožnil prekopírovať si do tabuľky všetky cesty na ktoré učiteľ chodí a potom už len na ne klikať podľa potreby štandardným postupom CTRL + pravé tlačidlo myši. Rovnako si môže prekopírovať mená všetkých svojich študentov do ďalšieho riadku tej istej tabuľky a taktiež si vytvoriť jedným kliknutím tabuľku so zoznamom študentov. V priebehu výskumu učiteľ učil obvykle naraz päť až stovku študentov v daných študijných programocha podľa potreby si teda vytváral vlastný spôsob práce. Napríklad keď učil stovku študentov, tak mal každého študenta v jednom riadku a mata informácie využil na roztriedenie študentov do blokov podľa krúžkov. Počas semestra potom manuálne alebo poloautomaticky si viedol potrebné záznamy, poznámky, inštrukcie a podľa potreby ete urobil jednu alebo dve tabuľky (medzi tabuľkami sa dá preskakovať s použitím klávesovej skratky CTRL-ALT-F6). Takáto špecifická tabuľka sa veľmi osvedčila aj pri záverečnom skúšaní študentov na konci semestral. Učiteľ si jednoducho prekopíroval do nej z AIS skupiny študentov, ktorí sa prihlásili na skúšku a porovnával počas písomnej prípravy, ako student pracoval v priebehu semestral. Z tabuľky si priamo prklikával na ich semestrálne práce, tesyt,alebo maily, čo s nimi komunikoval.

V reálne výučbe si učiteľ vytvorí hlavnú tabuľku s plain textom, ktorá potom má obvykle 20-30 riadkov a v daných regiónoch má uložené informácie a vedomosti . Takúto "edukačnú" knowledge table si treba predstaviť, ako edukačný balík, kde má učiteľ všetko pokope a tabuľku prenášať z práce na domáci počítač alebo notebook na USB kľúči alebo natiahnuť na fakultný server s virtuálnym vzdelávacím priestorom. Ak niekto vidí podobnosť s informačnými systémami, LMS (AIS, Blackboard,) tak áno, je to učiteľov osobný IT nástroj, ktorý polní všetky tieto funkcie.

Tu treba zdôrazniť, že v ďalšej časti tvorba edukačných balíkov sa tiež bude používať termín edukačný balík, avšak v tom prípade sa edukačné balíky budú vytvárať poloautomaticky až automaticky z počítačových o súborov. Čiže nepôjde o zostavu vedomostí (uložených v tabuľka WPad) ale o zostavu súborov (prepojených cez tabuľku WPad). Tieto veci sa nesmierne ťažko vysvetľujú kolegom alebo aj IT odborníkom, ktorí sa s taouto personalizovanou IT paradigmou nikdy nestretli. Čiže nerozumejú, že ide o nový spôsob prenášania vedomostí či už medzi ľudmi alebo človekom a strojom ým obsahom. Totiž v prípade učiteľa ide o jeho tacitné vedomosti vložené do tabuľky (prípadne aj exciplitné, ak tam kopíruje nejaké texty) – ide teda o redukovaný selektívny didaktický obsah. A nerozumejú preto, lebo ľudia si medzi sebou vymieňaju a posielajú informácie ako počítačové súbory (txt, html, pdf, doc, png, jpg, mp3,…), čiže neredukovaný obsah, resp. bez pridanej didaktickej hodnoty.

V tejto súvislosti treba zmieniť ešte jeden paradox, ktorí zatiaľ autori nedokážu prekonať ani vyriešiť, lebo súvisí s ľudskou psychikou. Ide o to, že WPad sa vyvíjal aj tak, že sštudenti mali v trieda každá dvojica prípadne trojica v lavici jedne počítač a na každom bol nainštalovaný WPad. Učiteľ teda vošiel do triedy a napr. Povedal: Otvorte si WPad kliknutím na ikonu na pracovnej ploche a zapíšte názov semestrálnej práce, mená, ročník. A použite klávesovú skratku CTRL-F1, aby sa urobila kópia ako html-súbor (tan automaticky otvorí prehladač).Alebo im dal úlohu, urobte na internete multi-rešerš na zadané kľúčové slová. A každému určil niekoľko termínov s určitým didaktickým zámerom. Napr. v predmete Základy environmentalistiky každý študent dostal hľadať na inernete napr. oxidácia, redukcia, voľná entalpia, amino kyseliny, fotosyntéza. Multi-rešerš znamená, že študent napr. zapísal v textovom stĺpci tabuľky pod seba týchto 6 slova, klikol na užívateľské menu a otvorilo sa mu naraz 6 okien prehliadača s výstupmi (v danom čase sa používala OPERA verzia 9.27). Takže student potom prekopíroval potrebný text z výsledkov vyhľadávania do tabuľky. No a po čase si učiteľ z počítačov študentov stiahol výsledné tabuľky, spojil ich do jednej, prekonvertoval na pdf-súbor a tan nahodil na fakultný server. Takýmto spôsobom sa kolabratívne vytvoril doučovací material z chémie, ktorý potom používali v nasledujúcich rokoch ďalší študenti na samoštúdium (poznámka - vedomosti študentov z chémie boli veľmi slabé a bez toho by nezvládli učivo daného predmetu).

No a ten paradox spočíval v tom, že za desať rokov vývoja softvéru WPad ani raz sa nevyskytol prípad, žeby ho nejeký student nevedel použiť. A to, platilo aj v prípade študentov so slabšími IT zručnosťami. Naproti tomu, keď sa ponúkalo využitie kolegom pedagógom, tak sa nenašiel nik ochotní WPad otestovať, pretože vždy povedali, že oni Používajú Google alebo kancelárske balíky a toto je nejaké zložité. Na prekvapenie doteraz WPad testovalo len niekoľko učiteľov, naposledy hlavne v rámci medzinárosného projektu,V4+ACARDC, ktorí si ho nainštalovali na svoj notebook alebo používali v prostredí virtuálneho stroja (fakultného cloudu), čiže používalina diaľku ako spoločný počítač na modelovanie edukačných balíkov. A najzaujímavejší je fakt, že Wpad pravidelne používa len jeden učiteľ a to na IT podporu virtually impaired (pozrite samostatnú sekciu tohto článku).

Dizajner tohto softvéru (hlavný autor tohto článku) si roky tento paradox nevedel vysvetliť, že prečo inteligentní kolegovia s oveľa lepšími IT skills než väčšina študentov nevedia použiť WPad a študenti s nízkymi IT zručnosťami nemali nikdy problem. No a vysvetlenie jeveľmi jednoduché a síce, že učitelia nevedia sami od seba na čo a ako WPad použíť. Na rozdiel od nich študenti nešpekulujú, či je program zložitý alebo jednoduchý ale vykonajú inštrukciu presne tak, ako im ju učiteľ zadal. Je však Pravda, že určitou bariérou je vždy čas potrebný na natrénovanie sa nového softvéru.

Tento paradox však bol veľmi užitočný pre ďalší vývoj softvéru, pretože vďaka nemu sa zmenil štýl programovania, t.j. začali sa programovať aplikačné menu. Aplikačné menu znamená, že sa viacero algoritmov spojí do jedného a výsledkom je, že učiteľovi alebo uživateľovi program funguje ako čierna skrinak, Čiže ak učiteľ niečo potrebuje, tak výssledok bude na jedni kliknutie. Tento princíp sa využil na tvorbu edukačných balíkov, ako bude ďalej vysvetlené.Na ilustráciu možno uviesť ešte ďalšie príklady. Na jedno kliknutie:

- sa stiahne, resp. zobrazí celý ročník IEEE časopisu, Computing Edge
- z univerzitnej databázy sa zobrazí po zadaní mená prehľad publikácií (napr. Pre každého učiteľa fakulty)
- po zadaní anglického kľúčového slova sa zobrazia všetky vety v zborníku alebo textovom zdroji, ktoré ho obsahujú
- po zadaní formátu, či názvu súboru sa mu zobrazí napr. výpis a tabuľka všetkých pdf-súborov na C-disku, USB a pod.
- po zapísaní PHP-zdrojového kódu sa výsledok automaticky zobrazí v prehliadači
- po zadaní kľúčového slova mu automaticky prehliadač otvorí výsledok a postupne sa vytvorí repository tabuľka.
- Otvorenie komunikačného kanála s možnosťou upload súborov z počítača – synchronizácia s CCM klaudom a ďalšie.

VI. Actual or Anticipated Outcomes

Treba ešte raz zopakovať, že výskum integrácie IT prebieha už okolo 15 rokov v prostredí výučby hlavne undergraduates. Jeho základným motívom je počítačova činností učiteľa ako kľúčovej osoby v procesch výučby a research je focusovaný na automatizáciu knowledge-based proceses (štartujúci pod dáždnikom technology-enhanced learning). V počiatočnej faze sa riešila automatizácia tvorby edukačného obsahu, ktorej výstupom boli eLearningové mateiály a edukačnej repository. Po zvládnutí tvorby obsahu sa výskum orientoval na IT podporu aktivít učiteeľa, ináč povedané, čo s tým obsahom robiť v rámci prednášok, cvičení a samoštúdia. No a kľúčovým highlight bolo, že je nutné riešiť softvérovo adaptáciu na operačný systém Window, WEB, virtuálne stroje a cloudy, čiže IT infraštruktúru v súčinnosti so state-of-the-art v tejto oblasti. V rámci kontinzálneho publikovania autori zdôraznili, že úroveň počítačovej popdory učiteľov a študentov je nedostatočná kvôli krátkej životnosto hardvéru a softvéru. Bežný univerzitný učiteľ potrebuje riešenia, ktoré mu fungujú 10-15 rokov, a túto požiadavku súčasná technológia nespĺňa.

V porovnaní so state-of-the-art popisované riešenie je zamerané na rýchle vkladanie edukačného obsahu do tabuliek WPadu, rýchla prístuipnosť, jeho rýchle spracovanie vďaka koncentrovaniu obsahu do aplikačných časových výstupov pre všetky druhy činností, ktoré učiteľ vykonáva, Čiže učiteľ opotrebuje univerzálny all-in-one software, ktorý to dokáže, lebo ináč by musel používať desiatku softvérov. Z tohto hľadiska základné riešenie pre tvorbu obsahu je asi najlacnejším a najefektivnejším riešením, pretože učiteľovi, či užívateľovi stačí mať notebook s nainštalovaným WPadom.

Aktuálny výskum ukázal navyše, že základom adaptácie na technológie je paralelná a synchrónna tvorba didaktických a informatických algoritmov. Tento fakt sa vo vedeckej literature nezmieňuje a nezdôrazňuje. V tomto kontexte sa

začalo riešiť modelovanie tvorby edukačných balíkov. Na rozdiel od bežného používanbia WPAd na tvorbu hromadného edukačného obsahu a informácií do knowledge tabuliek, v tomto prípade bolo potrebné začať riešiť hromadné spracovanie počítačových súborov. Každý učiteľ totiž sin a počítači vytvára zostavy súborov, ktoré má v rôznych priečinkoch počítača a často ide o stovky súborov v desiatkach počítačových formátoch (texty, obrázky, zvukové súbory). No a málokto si uvedomuje, že bežný učiteľ má na svojom počítači obrazne povedané malý internet. NA ilustráciu možno uviesť, že na notebook užívateľa je okolo 600 tisíc súborov. Samozrejme, do toho patria aj súbory Windows a softvérov, avšak z hľadiska najbežnejších formátov ako sú txt, pdf, doc, ide rádovo o desiatky tisíc. No a edukačný obsah má práve v nich. Takže vývoj softvéru musel tieto veci zohľadniť. Z tohto hľadiska bolo dôležitým míľnikom začať využívať virtuálne stroje na cloudoch (nainštalovanie WPad) a cloud content management (BOX cloud – zdieľnie dokumentov). Tomu bežný učiteľ nerozumie, takže išlo o to, že fakultní IT staff nám poskytol diaškový prístup na počítač s Windows 10. A tento počítač spoločne používalo okolo desať učiteľov z piatich krajín. Tým sa riešilo aj to, že je ťažké montivovať kolegov, aby si nainštalovali WPad na svoj počítač. Čiže v tomto prípade používali všetci vzdialený počítač a na ňom bol nainštalovaný WPad. Takže mohli spoločne modelovať viacjazyčnú podporu a teda tvorbu edukačných balíkov.

Fig. 3 ilustruje princíp tvorby edukačných balíkov. Ten je založený na tom, že učiteľ má uložený edukačný obsah v rôznych priečinkoch a počítačových súboroch rôzneho formátu. Tieto si manuálne prenesie do default folder (na obrázku Mix-Folder) a z menu WPad si vyberá možnosti na tvorbu Edu-Pack.

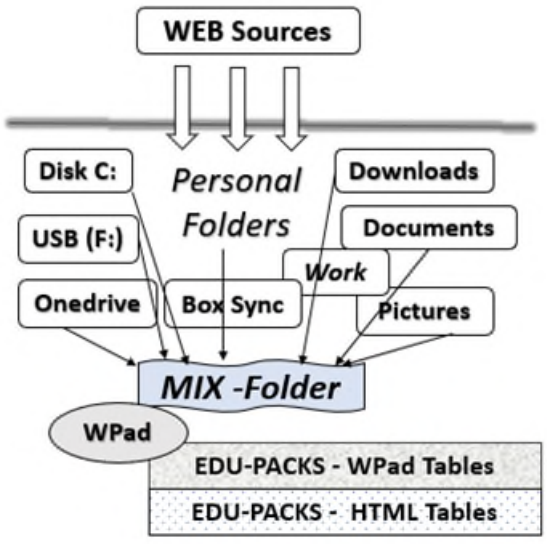

Fig. 3

Základná možnosť je, že sa vytvorí WPad tabuľka, ktorá má toľko riadkov, koľko súborov je v adresári. V jednotlivých riadkoch sa vyznačia názvy súborov a v textovom poli cesty. Po kliknutí na CTRL-F1 prehliadač automaticky otvorí html-zostavu, ktorá je prekonvertovanou WPad tabuľkou. Takže výsledok je, že učiteľ má skoncentrovaná obsah do jedného balíka, ktorý používa podľa potreby na notebook alebo uploaduje na virtuálny vzdelávací priestor fakulty alebo na verejne prístupný WEB. Aj keď takýto edukačný balík sad á použiť vo výučbe a je dostupný aj pre študentov, v reálnom živote učiteľ vykonáva viacero didaktických algoritmov a každý si vžaduje inú modifikáciu edukačného balíka. Prakticky to znamená, že tabuľku treba ešte upraviť podľa okamžitej potreby výučby. Z hľadiska programovania to však predstavuje širokú paletu potenciálnych riešení, napr. učiteľ:

- má už hotový edukačný obsah v súboroch, ktorách názvy sú zrozumiteľné
- nemá v súboroch kompletný edukačný material
- si chce do tabulie natiahnuť aj obsah neformátovaných textových súborov (plain text, html)
- si chce do tabulie natiahnuť aj obsah súborov viacerých formátov (texty, obrázky, audio) – tu potom záleží na počte súbborov, pretože ak je vela súborov, tak pamäť počítača nestačí
- chce vytvoriť edukačný mamteriál s vysokou didaktickou kvalitou – do tabuliek si musí dopísať texty alebo aj html-texty (treba si uvedomiť, že každý riadok sa prekonvertuje na smaotatnú html-stránku, čiže tabuľka generuje množinu spojených html stránok)
- chce vytvoriť edukačný material vysokej informatickej kvality – prakticky to znamená, že obsah je koncentrovaný na jednej obrazovke počítača a umožňuje rýchlu navigáciu nahor aj nadol a obsahuje linky na priame otvorenie edukačných súborov a linky na edukačný oibsah a portály na WEBe.

NAIdeálČo teda edukačný balík je sa najlepšie vysvetlí na príklade poľského výskumníka, ktorý pôsobil v projekte V4+ACARD.

e The paper presented an interdisciplinary IT support design for engineering education, which is implemented in engineering education and is especially suitable for STEM teaching. Namely, virtual knowledge enables work with texts, images, computer files and thus also visualize educational content and activities, which is primarily in STEM, in contrast to managerial and humanities subjects, where text is used more. It has been explained that universality is given by the concept of virtual knowledge, which the computer understands as a representation of knowledge (as a kind of information - because the computer does not work with knowledge but information in the form of bytes). As part of a long-term solution of IT integration into teaching, a personal support system has been developed that can be used primarily by the teacher as an educational IT tool for any activity he / she performs (teaching, creating eLearning, research, publishing) and which can serve as an educational tool for his students. The paper presents examples from the creation of educational packages and support for visually impaired education and the vision is to continue programming with a vision of an intelligent educational structure. In terms of limits, it should be emphasized that IT integration is interdisciplinary and consists not only of pedagogical algorithm design and parallel

design (didactic algorithms must be defined, otherwise they can not be programmed), but the most difficult thing is programming adaptation on Windows, networks and clouds, which is time the most demanding. It should be mentioned that this is a research of technology that has not existed before and its basic thesis is to solve a prototype of how thousands of educational activities can be simulated. The authors surprisingly encounter misunderstandings on the part of teachers, or even pedagogical journals, who do not accept this phase of research. In other words, they only recognize if some students work without a computer and part with a computer to test some hypothesis. From this point of view presented new technology, educational software can be used e.g. In Humanities PRE * POST Academic Research. Logically, however, they could not do it if there was no research to develop and supply this technology.

What is meant by knowledge representation?

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A. Some Common Mistakes

- The word “data” is plural, not singular.
- The subscript for the permeability of vacuum μ_0, and other common scientific constants, is zero with subscript formatting, not a lowercase letter “o”.
- In American English, commas, semicolons, periods, question and exclamation marks are located within quotation marks only when a complete thought or name is cited, such as a title or full quotation. When quotation marks are used, instead of a bold or italic typeface, to highlight a word or phrase, punctuation should appear outside of the quotation marks. A parenthetical phrase or statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.)
- A graph within a graph is an “inset”, not an “insert”. The word alternatively is preferred to the word “alternately” (unless you really mean something that alternates).
- Do not use the word “essentially” to mean “approximately” or “effectively”.

Aj nezainteresovaná osoba pochopí, že by bolo možné uvedené riešenia pokryť samostatným softvérom. Takto sa štandardne rieši vývoj softvéru, avšak potom by WPad nemohol byť all-in-one systém. Čiže výzvou je vybrať najviac sa vyskytujúcich edukačných situácií. Takže sa doplní aplikačné menu len on jednu až tri položky, Dôležité je, aby sa aj učiteľ prispôsobil počítaču, t.j. prispôsobí si organizáciu učiva a vhodne si označí súbory a texty. Vtedy sa radikálne zníži počet informatických algoritmov a jednoduchšie rieši adaptácia.

Ako príklad možno uviesť edukačný balík, ktorý riešil poľský výskumník v rámci projektu V4+ACARDC. V jeho prípade mal hotový edukačný materiál – skriptá v pdf-súboroch. Takže do tabuliek sa natiahli cesty k pdf-súborom a manuálne do textového poľa doplnil didaktický text. Fig. 4 je ukážkou z výstupu na WEB. Kliknutím na číslo záznamu alebo na wyk4.pdf (vyznačené ručičkou) sa otvorí časť textu skript k programovaniu v AJAX.

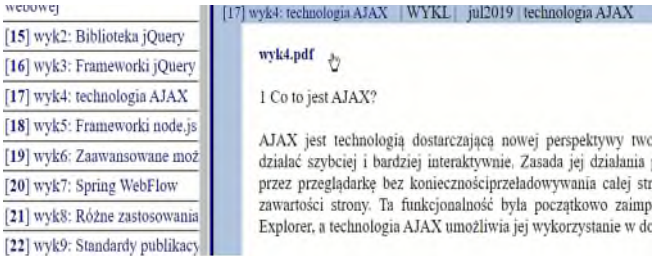

Fig. 4

Predchádzajúci popis ilustruje široké možnosti riešenia tvorby edukačných tabuliek pre špecifický učebný portál, kde teda je možné orientovať ďalší interdisciplinárny výskum.

CONCLUSIONS/RECOMMENDATIONS/SUMMARY

The paper presented an interdisciplinary IT support design for engineering education, which is implemented in engineering education and is especially suitable for STEM teaching. Namely, virtual knowledge enables work with texts, images, computer files and thus also visualize educational content and activities, which is primarily in STEM, in contrast to managerial and humanities subjects, where text is used more. It has been explained that universality is given by the concept of virtual knowledge, which the computer understands as a representation of knowledge (as a kind of information - because the computer does not work with knowledge but information in the form of bytes). As part of a long-term solution of IT integration into teaching, a personal support system has been developed that can be used primarily by the teacher as an educational IT tool for any activity he / she performs (teaching, creating eLearning, research, publishing) and which can serve as an educational tool for his students. The paper presents examples from the creation of educational packages and support for visually impaired education and the vision is to continue programming with a vision of an intelligent educational structure. In terms of limits, it should be emphasized that IT integration is interdisciplinary and consists not only of pedagogical algorithm design and parallel design (didactic algorithms must be defined, otherwise they can not be programmed), but the most difficult thing is programming adaptation on Windows, networks and clouds, which is time the most demanding. It should be mentioned that this is a research of technology that has not existed before and its basic thesis is to solve a prototype of how thousands of educational activities can be simulated. The authors surprisingly encounter misunderstandings on the part of

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ACKNOWLEDGMENT

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REFERENCES

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What is meant by knowledge representation?

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