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A Digital Platform for Managing Virtual Internships*

NENAD STEFANOVIC, ZARKO BOGICEVIC and DANIJELA MILOSEVIC
Faculty of Technical Sciences in Cacak, University of Kragujevac Svetog Save 65, 32000 Cacak, Serbia.
E-mail: nenad@ftn.edu.rs, zarko.bogicevic@ftn.edu.rs, danijela.milosevic@ftn.edu.rs

Virtual internships (VI) enable students, especially those in engineering domains, to gain real-world experience and skills in a remote online setting. Even though they offer several advantages over traditional internship programs, these benefits have not been fully realized due to many challenges related to organization, VI models, information technologies, communication, and collaboration. This paper introduces the specific VI lifecycle model and the methodology for VIs with practical workflows and guidelines, which enable design of adapted and flexible internship programs. For successful management of VIs, a web-based digital platform is designed and developed. It is based on the proposed VI lifecycle model and methodology, and it connects all parties (students, schools, and companies) within the secure and collaborative digital environment. Its architecture is multitiered and it is based on microservices and open standards, so it can be customized for specific VI scenarios, or integrated with other specialized e-learning platforms that complement VI user experience. The digital platform contains specialized components that support specific VI tasks, such as Internship database, Lectures, Assessments, Company Profiles, Assignments, etc. This enables more flexible, efficient, personalized, low-cost, and adaptive solutions for VIs. The proposed VI model and digital platform were successfully applied in several southeastern European countries, demonstrating applicability and flexibility of the approach. The results, based on various surveys and the system and user data from the digital platform, show a higher level of collaboration, better communication, increased level of professional knowledge, and acquired skills related to online teamwork and collaboration.

Keywords: virtual internship; web platform; internship model; vocational education and training

1. Introduction

Internships are gaining more importance in terms of increased education and globalization of our professional world. Standard internship models now face several challenges. These include rapid changes in business environment, globalization, uneven economic development, shorter knowledge lifetime, and constant advances in ICT, among others. Traditional internships, where the learners must move or travel, are not always possible due to financial, geographical, social, or other reasons (e.g., disabilities, social exclusion, legal constraints etc.). In today's globalized working environment, students who are able to work in a multi-national, cultural, and ethnic environment, will be more prepared and successful. However, majority of engineering students do not acquire such experience during their studies. Virtual internships can give students an opportunity to carry out their internships with foreign companies and to collaborate on projects with students from abroad [1]. This is particularly useful for students and schools from developing countries, and during the special circumstances such as pandemics, wars, or natural disasters. There are plenty of difficulties to overcome, especially in developing countries, where internships are not available to all potential students (interns), due to unbalanced economic development between different geographic areas and inadequate transportation infrastructure. Also, there are challenges related to educational processes and communication between the students, schools, and companies.

To solve some of these challenges, virtual internships (VI) emerged as a solution. VI is defined as "a set of ICT (Information and Communication Technologies) supported activities that realize or facilitate international, collaborative experiences in a context of teaching and/or learning" [2]. However, existing solutions are not suited to host virtual internships, as they do not support the workflows and VI specific processes due to their various limitations [3, 4].

With remote work, online classes, courses etc., gaining popularity among younger generations, this perception of virtual internships is starting to change. Additionally, natural disasters and global health issues such as pandemics also gave rise to remote work and collaboration, making virtual internships even more important. Another important factor is the entire user experience of the virtual internship system. The system must be capable of facilitating all the necessary activities for the internship to be successful. In order to do this, it must provide the necessary services and tools.

In the following sections, background research on virtual internships is presented, and the specialized and adaptive VI model is introduced. The main elements, features, and advantages of the

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model are described. Finally, the collaborative software platform for VI based on the proposed model is presented. The VI model and the VI software solution are specifically designed and developed to overcome the main issues and deficiencies of the existing e-learning systems.

2. Background Research

Internships are not a new concept. Internship programs are designed to provide all parties involved with mutual benefits [5]. They are also great for creating a good work ethic and values, getting used to working and increasing employment opportunities [6, 7]. Internships are especially important in engineering education. The study conducted by de Maria et al. [8], showed that 98% of mentors and 85% of students were satisfied with the industrial internship mentoring model. Internship models like this are also strengthening relationships between universities and organizations. Virtual internships provide opportunities especially for engineering students to develop design thinking, problem solving, and creativity through online collaboration, teamwork and feedbacks from teachers and mentors [9]. One of the studies showed that by including clients (customers) within virtual internships improves overall design process in terms of product quality and costs, while students, besides expert competences, also develop entrepreneurial skills [10].

Virtual internship platforms have been developed in the past, however, mostly with inadequate results [11–13]. The main problems were related to deficiency of specialized web platforms that support VI specific processes, activities, and collaboration. Despite obvious benefits, virtual internships in VET (Vocational Education and Training) and higher education are currently carried out rather rarely. Nevertheless, there are some examples of virtual internships both in VET and higher education, and in various industries (computer engineering, management, engineering, health, tourism, design, finance, law, etc.), usually run by a commercial intermediary. Some educational institutions and companies have set up remote virtual laboratories and digital twins to provide education and training for students that do not have access to such environments. However, virtual internships are often not executed properly and sometimes ends up being abandoned shortly after initial set up. The main reason includes the lack of the specialized VI web platforms which can support the workflows and activities tailored for the specific virtual internships, and the integration with other information technologies (IT) in engineering and industry.

Most research done so far takes the ICT aspect as a supporting role, for example, in the EU-VIP and Intern projects [14], the ICT platforms and tools had a supportive role, while in the case of fully virtual internships the platform and tools themselves will have a much bigger and more responsible role, as they could, just like the human factor, make or break the virtual internship experience. It comes out clearly that the general ICT related skills can be identified somehow as one of the core enablers of the virtual internships. IT knowledge is required for efficient and effective use of VI web platforms – authentication, content management, document management, search, working with assignments, calendar, online meetings, etc. Preparing teachers for the virtual environment is not a new concept and has been around for quite a while [15]. There are still issues of teaching staff being resistant to Virtual Learning Environments (VLEs) and not exploring them to their full potential.

Nowadays, people are looking for more flexible learning to accommodate their needs for improvement. This is shown by the rising trend of online courses, e-learning platforms, video tutorials, etc. The Internet has provided people with almost unlimited access to information. With online learning, lifelong learning has become more accessible, hence the rising percentage of lifelong learners. In virtual internships, the relationship. Collaboration, and communication between the learner, mentor, and teacher, are the critical factors which determine the success of the VI program [16].

Web platforms proved to be most effective for various educational and training purposes. Many schools have implemented some LMS (Learning Management Systems) such as Moodle and Canvas, or e-learning web platforms such as Google Classroom or Microsoft Teams, to support learning, teaching, and collaboration. However, such platforms that are mainly used for classic e-learning models, showed to be inadequate for virtual internships and vocational education and training, primarily due to specific educational models, workflows, and activities of the VIs. Nevertheless, some of those platforms provide extensibility or integration with external systems and services. This way, they can be customized and adapted for specific VI models and scenarios.

Based on the academic and industry research and studies, it is evident that VIs are one of the key elements for present and future professional development. The effectiveness of Vis is even greater in developing countries, such as western Balkan countries. However, there is a lack of existing models and software solutions specifically designed and developed for this kind of internships. In the next section the innovative and adaptive model for VIs is presented.

3. The Virtual Internship Model

To realize successful virtual internships, it is necessary to design an adequate lifecycle model, concrete workflows, and activities. Based on the background research and concrete experiences gained from the VIVET project [17], and the current state of the VET and internships in several Balkan countries [18], the specialized adaptive lifecycle and workflow model for virtual internships was designed. After the successful piloting of the VIVET project, the model was further refined and extended, and workflows were improved based on the experience gained. Further adaptations were made to suit virtual internships for various VET and Higher education programs, following best practices for online student engagements. The model combines certain elements from the leading existing continuous improvement and IT service management models, and it utilizes the iterative and the phase-based approach for VIs with concrete workflows.

This section focuses on two key aspects:

1. The flow of the development of the VI
2. Practical steps and the possible methodology of putting a VI into practice

3.1 Developing the Virtual Internship Lifecycle Model

Based on the specific nature of virtual internships and the existing research results and practices, an iterative multi-phased and adaptive model is proposed. It consists of the following five phases: strategy, design, implementation, operation, and improvement (Fig. 1). Each phase has its own workflows and inputs/outputs, as well as parties – students, schools (teachers) or companies (mentors).

Strategy – The main goal of this phase is to create VI strategy to serve students. It starts with the assessment and analysis of student's and company's needs. Then, it determines which VI services should be provided and what platform capabilities should be designed, having in mind requirements and needs of all parties involved.

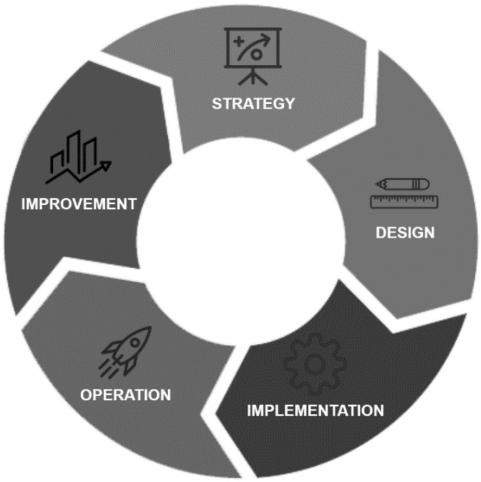

Fig. 1. Virtual internship lifecycle model.

This phase includes planning, gathering interest for VI and finding potential company partners to cooperate with.

Design – Based on the VI strategy and requirements, the design phase coordinates VI design processes, activities, and resources. It provides the consistent and effective design of existing or improved VI services, technology, processes, metrics, and information systems. The design phase also ensures that VI services are adequately designed in terms of availability, capacity, compliance, and security.

Implementation – The goal of this phase is to create VI services and to transition them to operations. It ensures that changes to processes and services are carried out in a coordinated and controlled manner. It consists of service transition, support, validation, and testing, as well as change management, configuration management and knowledge management.

Both mentors (companies) and teachers (schools) should participate in the implementation process, ensuring that everything is implemented according to the plans created in the previous phases. The new and improved services (features) are deployed on the web system and necessary configurations and customizations are made to support required VI scenarios.

Operation – The goal of this phase is to ensure that VI services and processes are delivered and executed efficiently and effectively, while maintaining the agreed quality of service. This includes user requests fulfilment, incident management, problem solving, as well as ongoing operational activities. Operations phase also involves access management, IT infrastructure management, application management, and monitoring.

Improvement – The primary objective of this phase is to continually improve the quality, effectiveness, and efficiency of VI processes and services. It works with other phases to align VI processes and services with the needs of all parties, monitor performance, as well as to identify and implement improvements. This includes defining improvement strategy, measuring performance with metrics, collecting and processing data, analysis and information presentation, and improvement implementation.

3.2 Methodology for Virtual Internships

Methodology for developing and deploying VIs into practice involves several steps. To ensure the quality VI experience, it is necessary to define

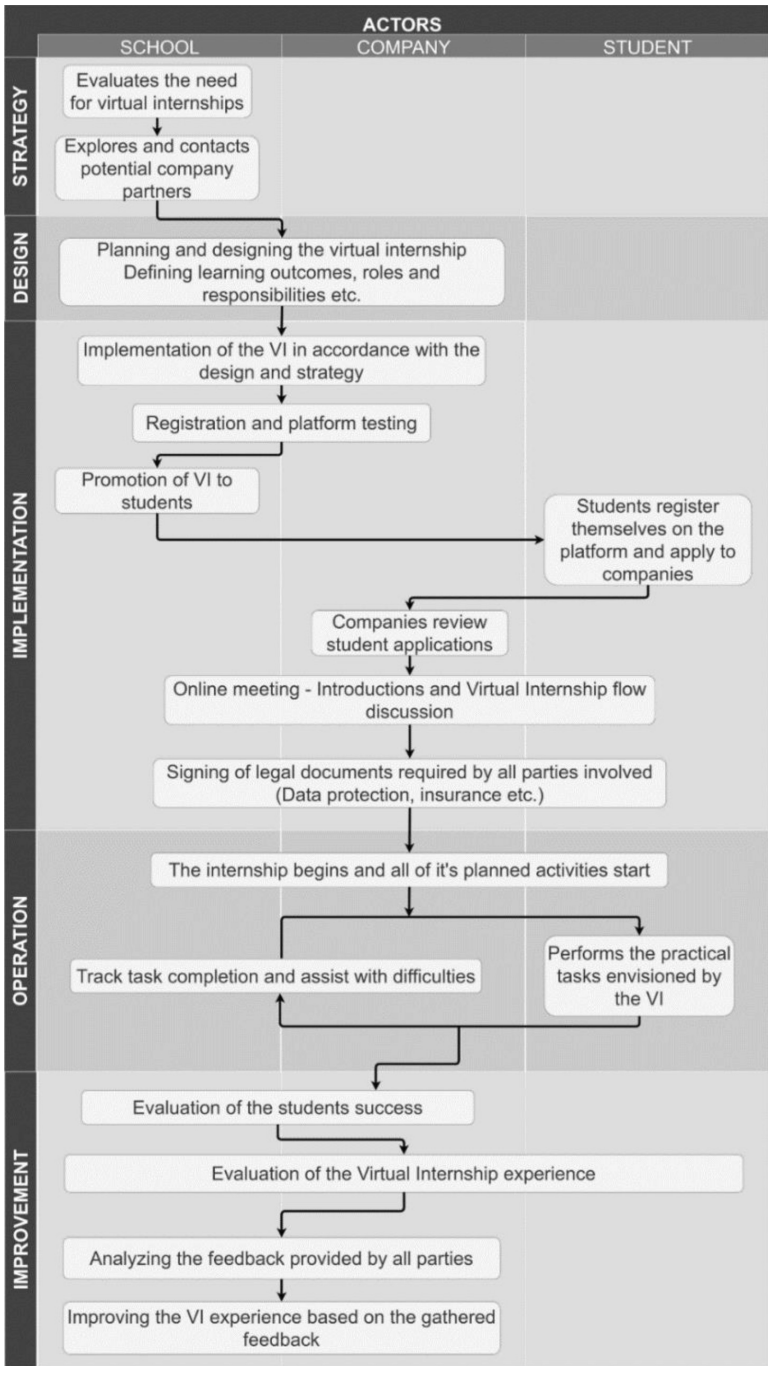

Fig. 2. Virtual internship activity workflow.

adequate workflows with concrete steps, relationships, and inputs/outputs. The activities and practical guidelines are in accordance with the presented VI lifecycle model. Fig. 2. shows the main activities and workflows across different lifecycle phases and roles (parties).

Planning the virtual internship involves a meeting (online or face-to-face) between the school principal, teachers, and company officials to match interests and learning outcomes. The team needs to determine which learning outcomes match the companies and are defined in the school curricula. After that, a project plan is drawn containing activities, goals, duration, deadlines and required knowledge. The schools determine which teachers will play the tutor role and the company determines which employees will be company mentors. Both teacher and mentor register themselves on the VI platform and read the guidelines and materials provided on how best to utilize the platform to their needs.

During the next phase, the school and teachers promote the VI to motivate students to participate.

The teachers identify the student profiles that fit the requirements put in place during the previous phases. The teachers then invite the students to register them on the platform and fill out their education profile.

The company mentors check these profiles to see if they match the company's requirements. If all this matches, the company mentor, teacher, and student get in touch to hold an initial meeting and start the VI process. The teacher and company mentor describe the platform sections to the student, during this introductory meeting, along with the activities, goals, and deadlines of the VI.

After the VI has started, the tasks are assigned to the student while the teacher and mentor monitor the development of the internship according to the deadlines and activities, they assist the student when facing issues and difficulties while carrying out the tasks assigned to them. Once all the tasks are completed, the students deliver personal reports in the reporting section of the platform on how they carried out their internship tasks and other activities involved in their virtual internship experience, after which the teacher and mentor will guide the student in the reflection on their activities and tasks carried out, the knowledge acquired and the initial educational goals of the experience. There should be questionnaires in place to have all parties involved provide feedback for further analysis. This is crucial for future VI experiences and further improvements on existing ones.

4. Virtual Internship Web Platform Solution

To realize the proposed VI model, it is necessary to create a flexible, scalable, and functional web platform for virtual internships. The existing generic web collaboration platforms and content management solutions mostly provide common and similar functionalities and services. They do not support specific VI processes and workflows. To overcome these shortcomings, the specialized web platform for VI (called VIVET) was designed and developed [19]. Using the specialized VIVET web platform enables better VI performance and higher user experience levels. The platform is a substantially adapted and extended software solution based on the Chamilo open-source platform [20], making it available, free of charge, for further customization and use.

4.1 VIVET VI software solution

The platform consists of the three main layers (Fig. 3):

1. Server – contains the background services necessary to host the platform, such as the web server, relational database, file server and the platform core services.
2. Platform components – these components contain tools which may be used to create custom VI experiences that fit the needs of each VI individually. The VIVET platform uses open protocols and data formats, so it can expose internal data to external systems, and consume data from the external systems and present it on a VIVET web pages.
3. Front-End – This section of the platform represents the user experience, which is highly responsive, ensuring a seamless experience on computers, laptops, tablets, and smartphones.

VIVET platform supports the two main scenarios for deployment and operation – both on-premises and cloud-based configurations. The on-premises server solution requires certain investment in hardware and infrastructure, while providing physical control over the hardware used. This scenario also requires added IT staff for system operation and support. Having all of this in mind, on-premises scenarios can be more suitable when participants want more control over their systems, and where there is an existing infrastructure available.

On the other hand, the cloud scenario provides more flexibility and scalability with less in-front capital expenses and usually less ongoing expenses. Cloud resources can be scaled almost instantly and more easily. System continuity can be ensured by employing automated load balancing and disaster recovery services. Additionally, cloud solutions typically require less IT staff.

Platform components can be enabled or disabled depending on the need of the specific VI. Additionally, the new components can be designed and deployed if needed. These components provide extended functionality to the VI.

The platform enables registration and tracking of all parties – students (interns), mentors, and teachers. Students can search for companies or available internships. They can also contact companies, mentors or teachers using the platform communication tools, thus greatly reducing the time needed to start with the internship.

Components and features such as lectures, assignments, assessment, notes, and attendance provide services and tools for comprehensive training, learning, and testing. Lectures provide topic or chronologically based view of study materials, which can be in various forms like text documents, video, audio, presentations, computer programs, etc. The assignment component enables mentors/teachers to create various assignments for a student, or a group of students, with defined due dates, instructions, accompanying materials required for

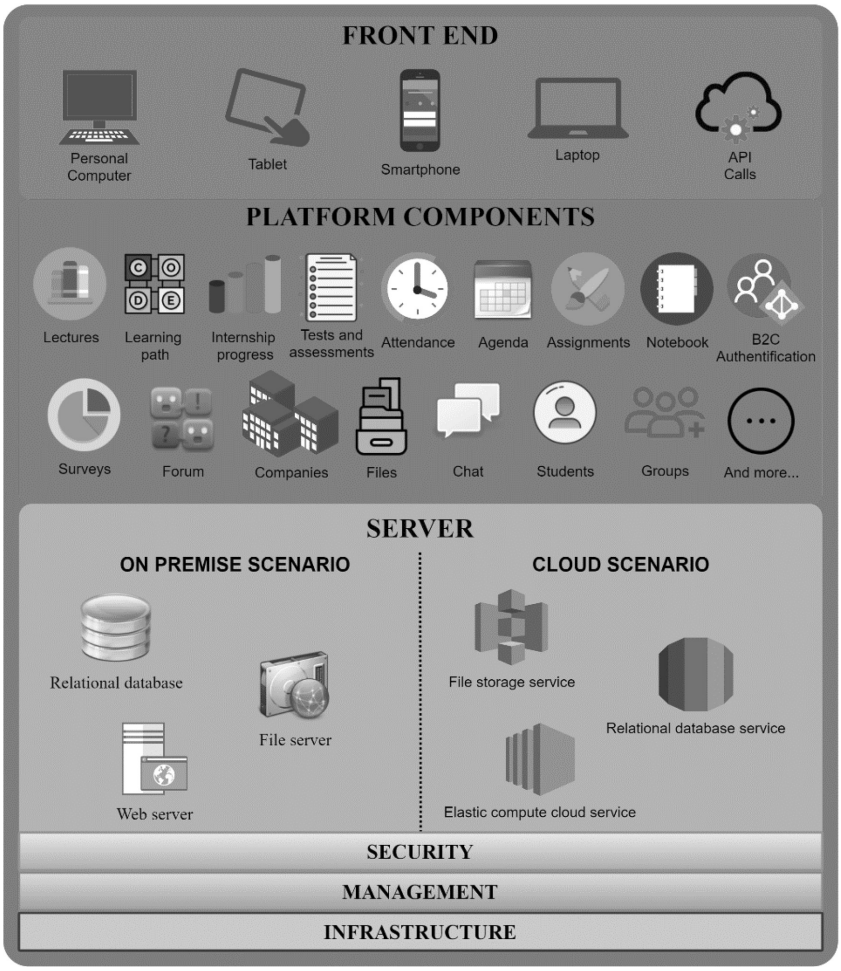

Fig. 3. Architecture of the virtual internship platform solution.

the assignments, grading rubric for each assignment, and 1:1 feedback. Students can create their assignment on the VIVET platform (using the rich text online editor with multimedia support), or upload any type of files (i.e., CAD/CAM drawings, computer programs/code files, etc.) for reviewing. Internship progress component shows the students' progress through the entire internship, and accumulates the points from lectures, tests, tasks etc. Attendance tracks the student's attendance at important meetings, live video lectures/conferences (if there are any), even physical attendance if it is necessary at some point during the internship, such as company visits.

Notebook is a personal workplace for students, and it is created for each internship (just as the student would have a notebook per normal school subject). It contains personal notes in the form of plain text, pictures, useful links, audio recordings etc. Files is a file sharing platform that allows students to store files and send or share them directly to their peers, teachers, and mentors.

Forum and chat allow the internship participants to communicate within the platform in the forms of discussion threads on certain topics, as well as one-to-one or group private chats. Interns contains the full list of all interns on the same VI, along with groups, which helps organize the interns more effectively. Users and groups can also subscribe to various events, thus receiving push notifications for relevant events or news.

Video conferencing is also one of the key features for the VI platform, since live in-person meetings can overcome barriers related to remote work and physical distance. The VIVET platform has a special video conferencing component based on the Apache OpenMeeting system. It enables users to make video/audio calls, meeting recording, screen sharing, digital whiteboards (drawing, writing, drag and drop, images, etc.), virtual rooms, etc. This component integrates with other components such as authentication, groups, calendar, surveys, etc. The personal profile page shows the user's profile photo and contact information such as Skype, e-mail, WhatsApp, and Viber, as given in Fig. 4.

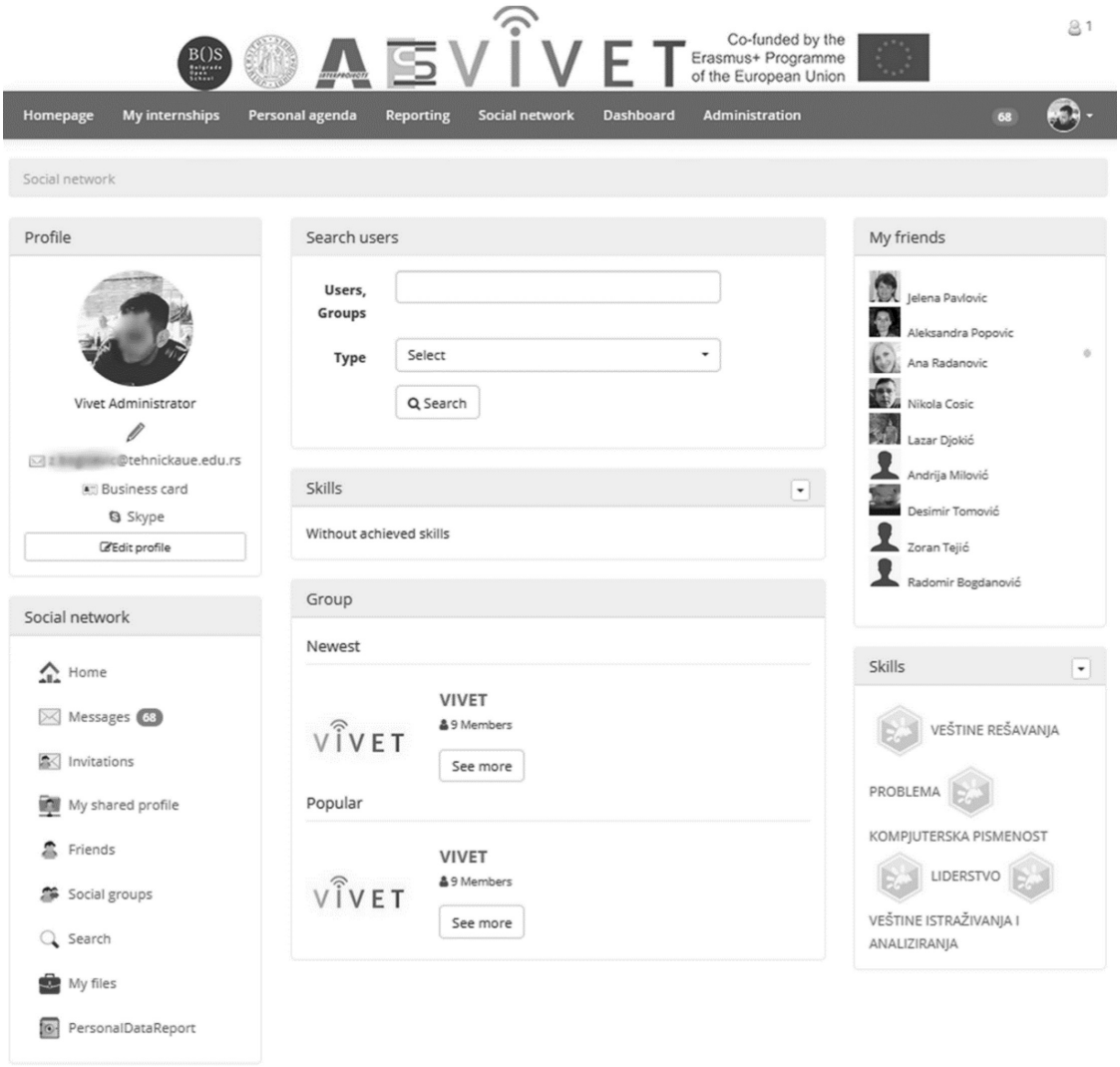

Fig. 4. Intern's personal profile view.

The profile page acts like a user's dashboard with personalized information and features. It also includes instant private messaging built into the platform, invitations to events and friend requests, friend lists, social groups, internship list, search form, and personal file storage. Students may also edit their personal profile data – adding their interests and customizing the profile to their preferences. In the upper right there is a notification section. Adding skills is highly recommended as they are shown to companies and may improve odds of being accepted for an internship. Writing about various topics of interest on the blog is encouraged, etc.

The companies customize how the students are greeted by creating the landing page. Companies choose components based on their needs. They may enable/disable components at any time, even during the internship. Generally, each internship is unique in a way, even two internships in the same company may differ and require different tools and adapting each internship is available through the VI platform.

The platform provides services for monitoring student progress, which can be very useful to monitor student login times, use case scenarios, habits and time spent on the platform to further improve the platform and the VI experience. This includes reports on test scores and averages, results, virtual attendance, time spent in online lectures, module access, user activities and many others. This way, teachers and mentors from companies can gain valuable insights and use them for better decision making and to take appropriate actions.

In today's digital era, security and compliance are particularly important. This is especially true with VIs, since almost all the data and information are stored, shared, and accessed via Internet and digital tools, and by various parties. Having this in mind, several security and compliance services are built

into the VIVET platform. The system supports users' authentication and fine-grained role-based authorization. Users can access data, information, pages, and features, based on their permission set. All communication between the client (web browser) and the server (VIVET system) is carried out via secured and encrypted connection enabled by the server's digital certificate and TLS (Transport Layer Security). The platform is also GDPR (General Data Protection Regulation) compliant, so that the user's privacy is ensured, which is an important part of the platform, as it contains private information of companies, teachers, and students.

Another key aspect of the platform is that it adheres to the WCAG (Web Content Accessibility Guidelines). This ensures that people with disabilities, using the specialized tools and features, can comfortably use the platform without the need of an assistant.

The VIVET platform provides several advantages and benefits when compared to those mainstream e-learning platforms. General software platforms, like Google Classroom, do not support VI specific processes, cannot be extended with apps (components), cannot be installed internally (i.e., school or company datacenter), and developers are constrained in what they can do. The VIVET platform supports VI specific processes, activities, and workflows, which are tailored for virtual internships. This makes it more suitable and effective for VIs.

The presented platform can be used both on-premises and in the cloud, depending on the organizational or national regulations and compliance requirements. It is a free and open-source platform that can be extended or improved by other developers. It uses standard open protocols and data formats, which enables connectivity and integration with internal or external software systems. The platform also supports the SCORM (Shareable Content Object Reference Model) standard, which makes it very flexible in terms that courses can be exported and imported in external compliant e-learning platforms, and vice-versa. Furthermore, platforms such as Google Classroom require integration with other services (such as video meetings, calendar, online content editing, etc.), while the VIVET platform have those services integrated within a single solution. When it comes to integration with other LMS, e-learning and other external systems, VIVET platform can be integrated in both directions (from VIVET to external system and vice versa) through configurations and extensions.

5. Results and Discussion

The VIVET EU Erasmus+ project involved 1225 participants (students, mentors, and teachers) in total: 225 directly reached and 1000 reached via the project web site and social media accounts. The project involved 31 companies from Italy, Bulgaria, and Serbia. The average age of teachers was 40 and the age of mentors was 46 years. The interns were students between the ages of 16 and 18, mostly from vocational high schools. During the piloting, which was conducted between November 2018 and March 2019, the platform received over 800 000 visits.

Several types of internships were offered during the piloting phase, in fields such as metallurgy, IT, graphics design, CAD (Computer Aided Design), etc. Companies maintain their profiles and publish internships offers. Students can search or browse internship catalog in accordance with their preferences. They design internships in coordination with the teachers, so that they combine methodological and pedagogical best practices along with specific needs of the companies for the future workforce. Mentors, teachers, and students used various VIVET components and services for management and realization of the internships such as lectures, communication and collaboration tools, progress monitoring, assessments, etc. All the students were assigned tasks and projects during their internship which they completed under the supervision of their mentors and teachers. After the internship is completed, all parties involved (students, mentors, and teachers) were surveyed using both structured and questionnaires regarding their VI experiences.

The VIVET platform has the capability to automatically log various events, actions, browsing, and usage data. This data, combined with feedback data from online surveys, generates a valuable source of information for decision making, actions, and improvements. This data from the platform was collected during the piloting stage, as well as a year after the piloting has ended. The methodology for data collection compromised questionnaires, real usage data, logs, and analysis of those logs.

Student-company pairing was done based on skills and interests, motivational letters, recommendations from teachers, online interviews with candidates etc. During the internship, monitoring of the students was conducted by both mentors and teachers. Another group of project-appointed platform administrators monitored the activities, while an IT engineer, who worked on the platform, was available for any technical difficulties. After enrolling more companies, students, teachers, and mentors and publishing additional lectures and study materials, the time users were spending on the platform increased significantly. For example, currently 41% users spent more than 30 minutes on the platform, compared to 31.7% previously.

When it comes to a daily usage, majority of the traffic is performed between 6AM and 10PM, with

most interactions (logins, web page access, downloads, edits, messages, etc.) between 1PM and 5PM. Teachers and mentors can send messages, post announcements and assignments, and schedule online meetings at certain time slots when the peak interactions are expected, and the communication is most effective. The log data also shows continuous increase in the total platform visits, unique user visits, monthly active users, as well as the average multiple visits per user per week. The results show that platform usage increases over time for all parties – students, teachers, and mentors. Based on the feedback surveys, VIVET users noted the following main reasons for spending more time on the platform:

- They needed some time to get acquainted with the platform.
- More companies joining the project.
- Added learning materials.
- Networking (peer-to-peer) effects due to more enrolled students.

Analysis of interactions during the piloting phase, as given in Table 1, shows intensive communication and interactions between the teachers, students, and mentors, using various synchronous and asynchronous communication channels, and platform components. Intensive communication puts the teachers and mentors in a more active and proactive roles, whereas in traditional internships teachers and mentors usually have more passive roles. This also keeps students more involved and committed to learning and collaboration, as well as assignments and projects completions.

Table 1. Platform interactions

Platform	Amount
Internships created	31
Internship descriptions added	117
Documents uploaded to internships	923
Dropbox files sent	264
Quizzes created	44
Quiz questions created	415
Surveys created	10
Internships with certificates	8
Messages exchanged	6288
Message attachments	278
Notifications	3162
Total internship access	24745
Total file downloads from lessons	2655
Total exercises	192

After finishing the pilot phase, users have filled the survey related to the VI model and the platform. The grading system is based on grading from 1-lowest to 5-highest. The part of the questionnaire and the grades are given in Table 2.

When students were asked to list what they liked the most about the virtual internship experience, the following answers were given:

- The ability to work remotely.
- The experience of working remotely for a company.
- New ICT and professional skills gained.
- Communication and problem-solving skills.
- Some parts of the platform feel like social networks.
- The teaching method and multimedia materials.

When asked to list what was the most useful part of the VIVET project piloting, students have noted the following:

- Meeting potential future employers/employees.
- Assessment and evaluation methods.
- Video presentations of companies.
- Flexible schedule.
- Simplified and multi-channel communication.

The teachers and the mentor's feedbacks, specified the following main reasons for joining the VIVET program:

- Supporting the acquisition of contemporary

Table 2. Post piloting questionnaire

Question	Grade (1 – lowest, 5 – highest)			
	Students	Teachers	Mentors	Average
Did the VIVET piloting meet your expectations?	4.8	4.3	4.4	4.5
How do you evaluate the whole VI model (methods, workflows, and activities)?	4.5	4.9	5.0	4.8
Was the content in the VI enough for gaining necessary practical skills?	4.4	4.7	4.8	4.63
Were the components (tools) provided with the platform satisfactory?	4.4	4.4	4.6	4.47
Was the communication between the teacher, mentor, and student satisfactory?	5.0	5.0	5.0	5.0
Were the goals set by the internship fully achievable?	5.0	5.0	5.0	5.0
Do you consider the VIVET project useful for future students?	5.0	5.0	5.0	5.0
Do you think that the skills gained from the VI are useful for the future jobs?	5.0	5.0	5.0	5.0
Were the features/components provided by the platform useful?	5.0	4.9	4.8	4.9

knowledge, skills, and competences of potential employees (students).
- Disseminating knowledge about providing virtual practice.
- Being able to solve support challenges.
- Increasing qualifications and career development of future employees.
- Better monitoring and tracking of students' activities.

Teachers, mentors, and students have positively reviewed the platform and the VI experience. Most platform components were fully utilized, with minor remarks for some functionalities of certain components, which were addressed and improved upon receiving the feedback. This way the system can be improved or extended to suit specific needs of the users.

Based on results analysis and user feedbacks, the main benefits of the proposed VI model (lifecycle and methodology) and the VIVET web platform are as follows:

- Specialized and adaptable model for VIs that provides well/defined phases, workflows, activities, performance indicators, parties, and incorporates best practices form the VIVET project.
- The VIVET web platform connects all relevant parties – students, mentors, organizations, teachers, and schools.
- The platform provides many components and features required for VI initiation, execution, and monitoring.
- It provides several communication and teamwork components and tools for any-to-any collaboration.
- Students have access to more internships, because they can realize internships at remote companies that are not accessible physically.
- Schools and teachers can monitor internships and track student performance.
- Costs can be reduced significantly for all parties; these include lower cost for traveling, accommodation, paperwork, office space, materials, etc.
- Organizations have access to more students and can more easily select adequate candidates and train them for their specific needs.
- Students gain better communication, organization, and time management skills. They also acquire skills and experience for operating in virtual work environments and using the appropriate tools.

According to the platform's system and user data, and the feedback provided from students, companies, and schools, it can be concluded that the proposed VI lifecycle model and methodology, complemented with the VIVET web platform provides a solid and effective ecosystem for virtual internships and vocational education and training. Further research can be carried out to provide more intelligent data analysis, real time monitoring and automatic recommendations for actions. The VIVET web system can be extended with new components and tools that provide even more efficient learning, teaching and collaboration. After the piloting, the platform remained in use by a number of schools, students, and companies, with a continuously growing user base. Long term benefit of the VIVET project is the creation of a sustainable model which will provide the acquisition of relevant work experience, skills, and competences, as well as higher and faster employability of young people from various educational levels.

The presented VI lifecycle model contains all the main phases necessary for creating, tracking, and improving the VI experience. The methodology, with VI specific workflows, provides concrete guidelines on how to design, implement, operate, and improve VIs. The web platform is adapted to the VI model and it has all the necessary components/features to facilitate efficient and effective VIs. Based on the data collected, questionnaires and surveys, students, teachers, and company mentors were very satisfied with the VI model and the platform, its capabilities, functionalities, components, and overall user experience. Furthermore, user feedback and system log data provided valuable information for process improvements.

Further research and development will be carried out related to extending and integrating the VIVET platform with other specialized e-learning and domain specific software solutions to provide more comprehensive user experience. The other segment of the future development will be toward extending the platform with widely used specialized software systems for various domains (engineering, manufacturing, etc.). Also, the research efforts will be made towards incorporating business intelligence and analytics capabilities to provide improved decision making based on derived insights. In addition to the technical improvements, work can be done to extend students user base with students from higher education institutions. During the piloting phase, most of the schools were vocational high schools, with one faculty participating in the program. The feedbacks showed that the proposed VI model and the VIVET platform can be successfully used in higher education as well.

6. Conclusion

Traditional internship models now face several challenges. These include rapid changes in business environment, globalization, uneven economic

development, shorter knowledge lifetime, and constant advances in ICT, among others.

Virtual internships emerged as a new internship model aimed to overcome some of the obstacles that traditional internships face. VIs enables students to remotely gain work experience at companies in a virtual and collaborative environment. VI concept removes barriers such as geographic distance, time, and costs. This is particularly beneficial for students coming from developing countries such as Western Balkan countries. Even though virtual internships models promise many advantages, there are still many challenges, especially related to researching and developing appropriate VI models, methods, techniques, and digital platforms.

This paper introduces the specialized VI lifecycle model and the specific VI methodology with concrete workflows and guidelines that enable quality design of tailored and adaptable internship programs. The VI lifecycle model is iterative, multiphased, and capable to be adapted to specific VI scenarios. VI methodology complements the lifecycle with concrete workflows, activities, and relations across lifecycle phases and roles. It incorporates best practices for VIs and ensures design and implementation of adapted and effective virtual internships.

The presented VIVET web platform was designed based on the VI lifecycle and supports the VI methodology, activities, and parties. It is a multilayered and service-based web platform with many features that enable initiation, execution, and analysis of VIs in a user-friendly, collaborative, and secured web environment. It was successfully applied in practice in Western Balkan countries, demonstrating excellent performance and sustainability. The analysis of the results and the key performance indicators showed the usefulness, effectiveness, and applicability of the proposed VI model and the VIVET web software solution. This should enable more adaptive, personalized, and ultimately more efficient and effective learning and training.

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Nenad Stefanovic is associate professor at the Faculty of Technical Sciences and Faculty of Science, University of Kragujevac. He received his PhD in Electronic Business from the Faculty of Organizational Science, University of Belgrade. His research interests include digital transformation of education, business intelligence, electronic business, and Internet technologies. Nenad is a member of several national and international ICT and education-related societies and research projects. He is Serbian national representative in two IFIP technical committees (TC 2 and TC 12) and a vice-chair of the TC 12 – Artificial Intelligence. He has published more than 90 research papers in national and international journals, conference proceedings and books. He holds the highest research rank (T1) assigned by the Serbian Ministry of Education, Science and Technological Development. He is editorial board member of several journals and conferences, and serves as a reviewer in some of the top-ranked scientific journals. Nenad also holds the Microsoft Certified Educator, Microsoft Innovative Educator Expert, and Microsoft Innovative Educator Fellow certifications awarded for outstanding contributions in education innovation.

Zarko Bogicevic is a PhD student at the Faculty of Technical Sciences in Cacak. He previously completed two master's degrees at the same faculty, one in Technics and Informatics and the second one in Information Technology. He was a professor of IT & electrical subject group at the Technical High School in Uzice. He published several research papers in national and international conferences. Zarko Bogicevic participated in the creation of the VIVET project for virtual internships where he was the lead role in developing the virtual internship platform. He has several years of experience as a network engineer, currently a cloud expert, DevOps engineer and an AWS Certified Solutions Architect at App Crafters.