



D3.3 Specification of adopted e- Learning technologies and methodologies

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ABSTRACT: Development and adoption of suitable e- Learning technologies and methodologies. University academic staff from RS will explore developed international and EU benchmarking approach and its applicability to the national contexts. Special attention will be given to quality e- Learning tools covering pedagogical, organizational and technical frameworks and their usability to national and institutional characteristics in RS.

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1 Introduction

The PT&SCHE project consortium is working towards the establishment of part-time and short cycle studies in Serbia. This document presents requirements and specifies aspects of the infrastructure needed to establish this type of studies at the Serbian institutions involved in the project. Some of the data presented in this deliverable stems from a questionnaire administered during a study-visit at the Open University of the Netherlands at 28. & 29. November 2016. Since the target beneficiaries of the project have different institutional profiles and goals, the target of the report was first to identify similarities and differences between the partners and then deduct specifications for a potential system to be implemented. PT&SCHE has no intention to build a complete learning infrastructure for all participating universities but rather to identify important functionalities and methodologies that a university should address in their individual practice to realise pt&sce-studies. Last but not least, deployment recommendations are provided.

2 Implementation context, goals, delivery modes and institutional capacity

The participating institutions have the shared goal to target the whole population in Serbia with their offer. Only one institution mentions to target a regional population. Initially, all but one institutions are planning to implement pt&sc studies for a specific study program. This initial offer will be based in all institutions on a partial reuse of existing course material. In terms of implementation of the provision of pt&sc studies, the participating institutions have different plans ranging from provision as an extension of a full-time offer to a completely separate provision (fig. 1). Summarizing, we can state that overall the institutions are targeting a similar implementation context with differences in the provision plans.

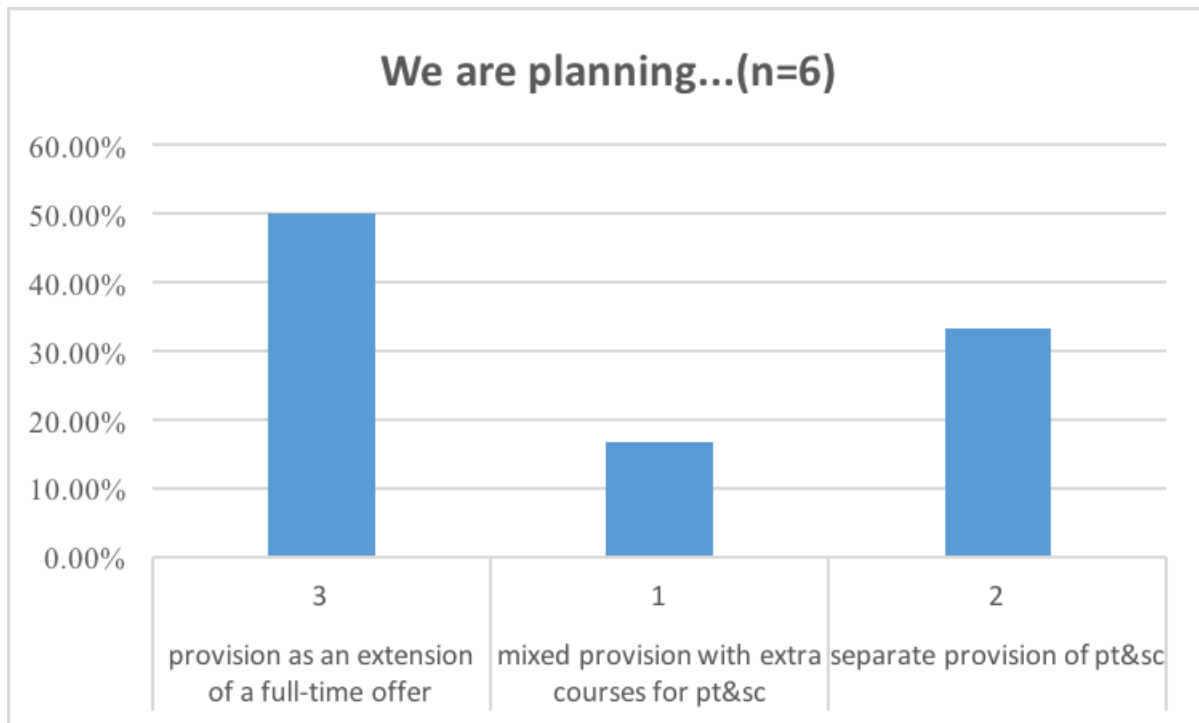


Figure 1: Provision strategy for pt&sc-studies

All participating institutions have plans to implement pt&sc-studies in a blended format. Looking further at the different types of implementation of these studies in a blended way, there are differences in the delivery mode. While some institutions are targeting a nearly fully online mode, there are also institutions that want to set priority to face-to-face delivery. Most institutions go for a mixed or mostly online delivery mode with regular face-to-face meetings (see fig. 2).

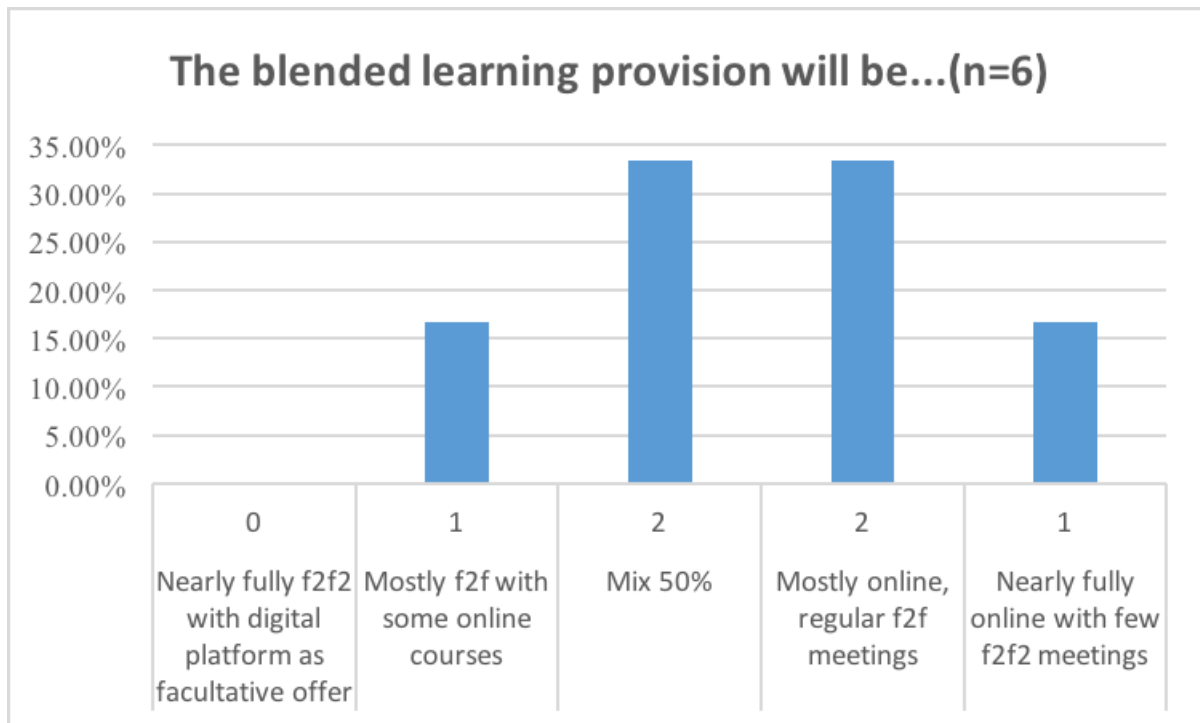


Figure 2: Blended learning strategy for pt&sc-studies

These differences can have important implications for the e-learning environments to be implemented at the different institutions at a later stage. An institution that uses digital services as an extension of mostly face-to-face-courses will have different needs than an institution that has a plan to fully implement pt&sc-studies online with face-to-face meetings as exception.

The institutions have different levels of awareness regarding technology-enhanced learning. Overall, there are three clusters of awareness regarding technology-enhanced learning. While UOK is at the stage of raising awareness, BCC, UNS and Viser are already trialing solutions for technology-enhanced learning. UOB and BMU are most advanced in the adoption of technology-enhanced learning.

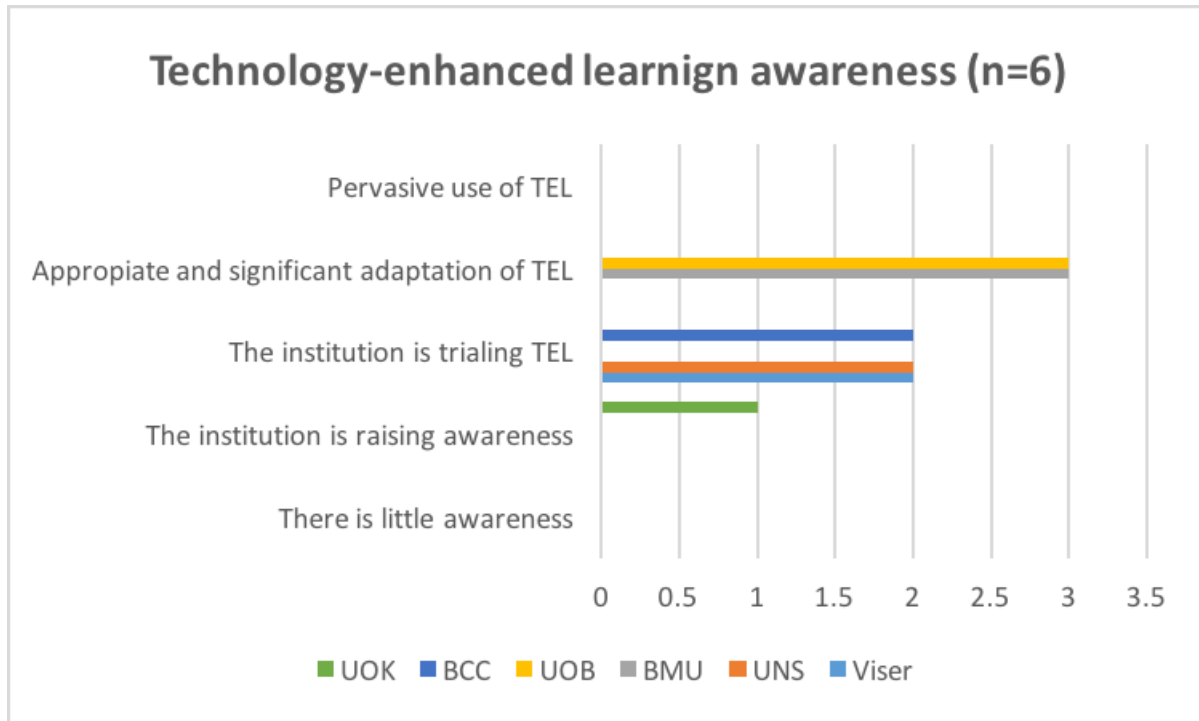


Figure 3: TEL awareness

The differences in awareness point to additional soft requirements that might be needed apart of the technology to be implemented. The introduction of pt&sc-studies would be a good opportunity to raise overall awareness of TEL at institutions with lower or medium awareness levels. There are also differences between the capability of the institutions (fig. 4).

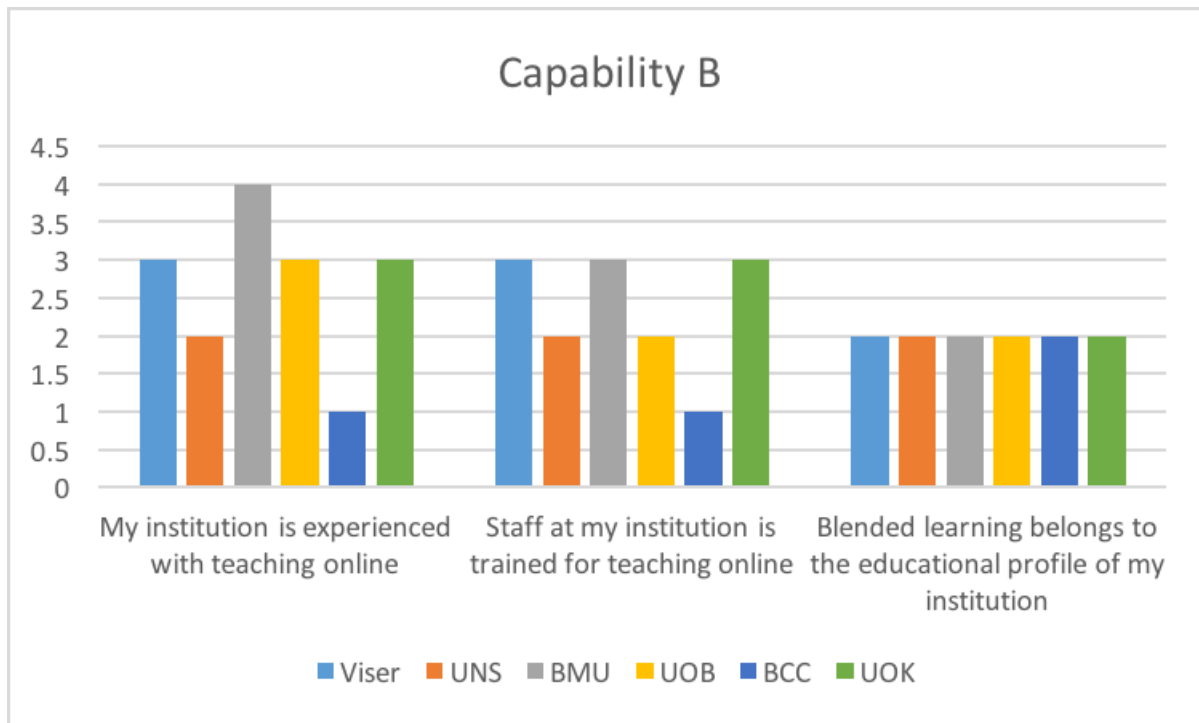


Figure 4: TEL capability

Especially staff training for supporting students online and for managing communication and teaching via digital media will be needed in some of the institutions to make the implementation of pt&sc-studies a success.

The participating institutions have different plans for technology to be implemented for pt&scstudies. While a majority is planning to reuse existing (open-source) software, only one institution is planning to extend the current infrastructure and another institution is planning to develop a solution from scratch (fig. 5).

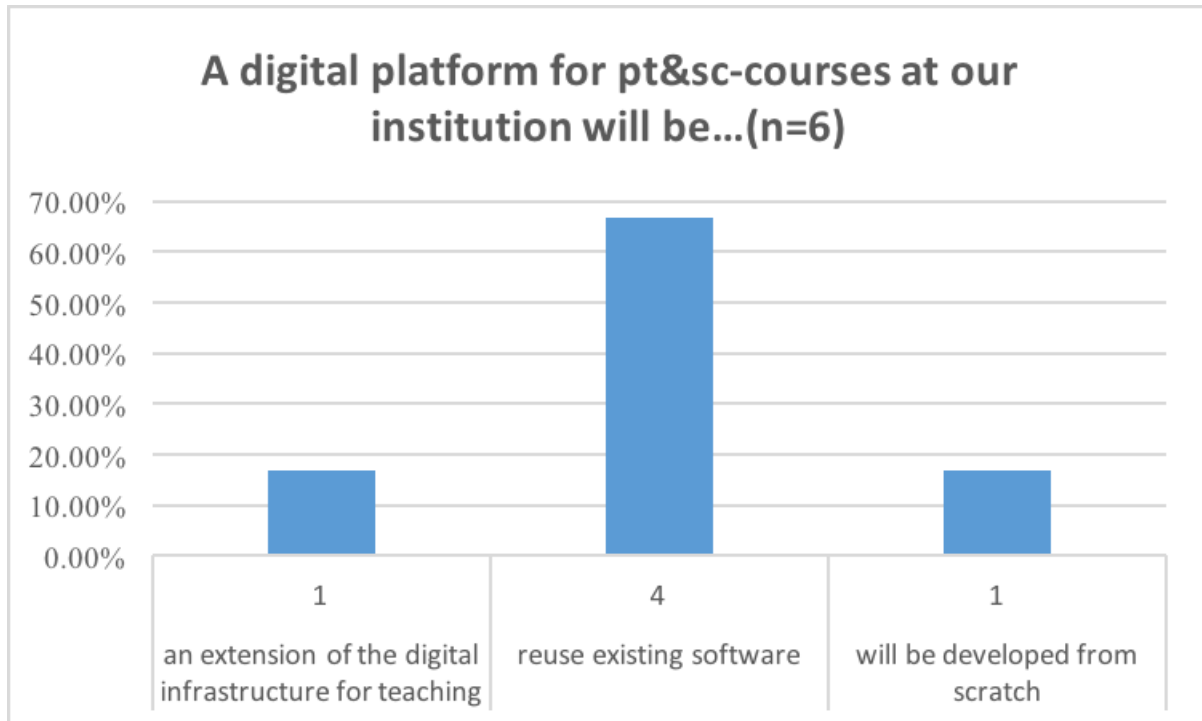


Figure 5: Platform strategy

Institutions have different visions in terms of important of features of the platform for pt&scstudies (fig. 6). Especially features like resource lists and tracking functionalities score high, while features like ePortfolios or a forum are not important for all institutions.

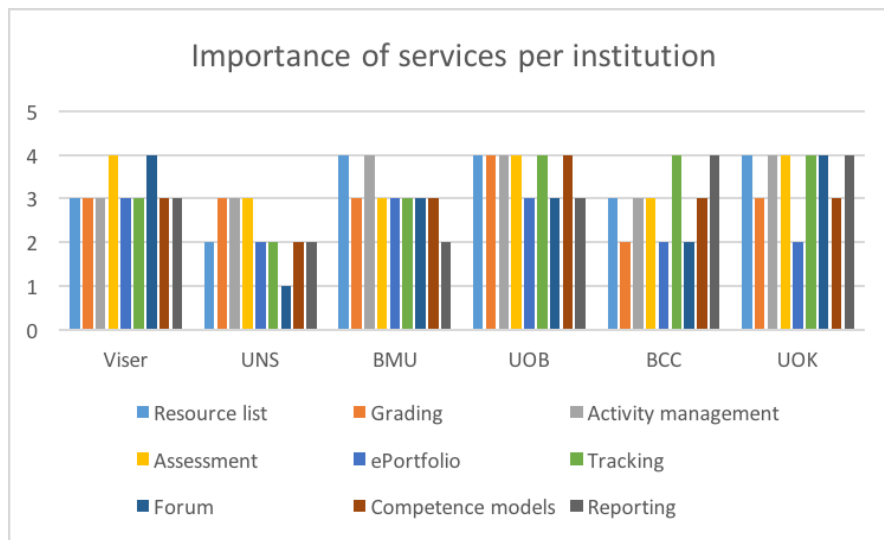
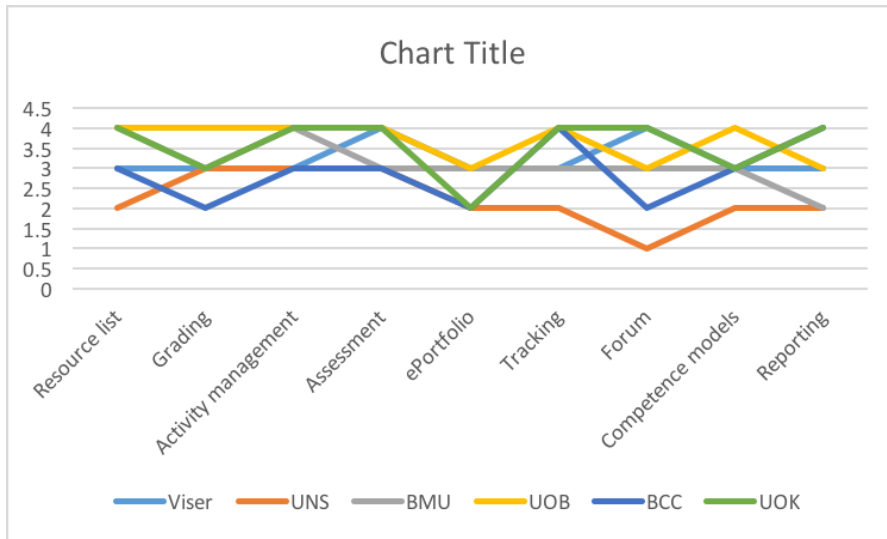


Figure 6: Importance of features for pt&sc-platform

In terms of assessment mode, most institutions plan to implement assessment functionalities online while implementing end-assessments face-to-face. Two institutions plan assessment fully face-to-face and one institutions expects to offer assessment fully online (fig. 7).

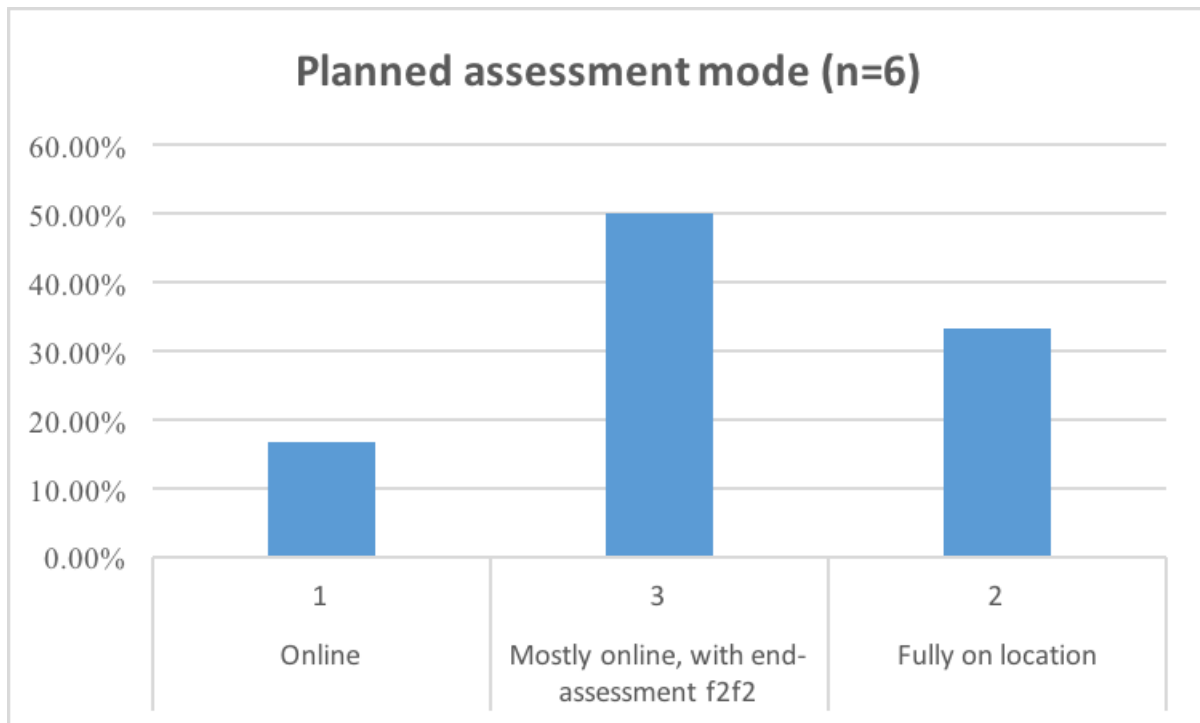


Figure 7: Planned assessment mode

The choice for conducting assessment mainly online has important implications for platform functionality that go wider than just the type of assessment (formative vs. summative). Especially, authentication plays an important role for online-assessment since it is often bound to legal conditions.

Also the choice for online-tutoring differs between institutions. While most institutions plan to offer online-tutoring for each course, 1 institution is planning to offer online-tutoring only on individual request (fig. 8).

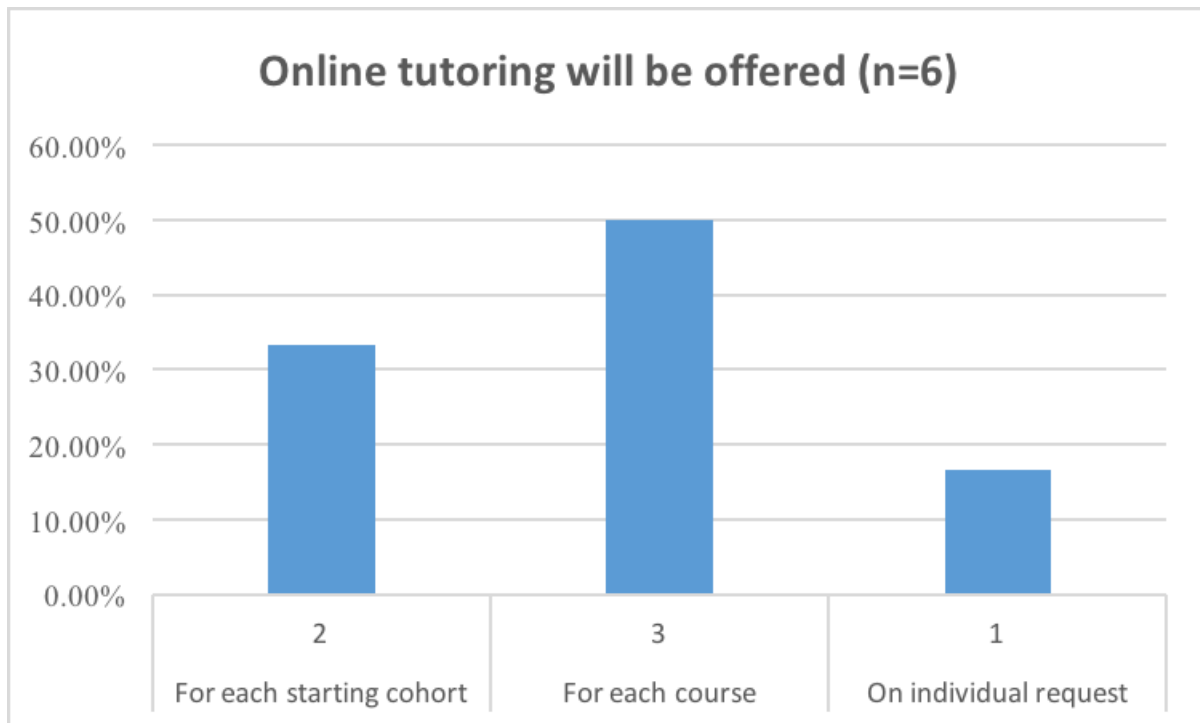


Figure 8: Online-tutoring in future pt&sc-studies

3 e-Learning methodologies

Based on the input by project partners we differentiate three implementation clusters for PT&SCHE studies:

1. Traditional face-to-face learning has been around for many years. Although there is no innovation here, this group has to be supported through technology. For instance, giving students access to course materials through an LMS or allowing them to synchronise via a digital calendar.
2. Blended learning combines online-learning and face-to-face learning. By using digital instruction students can work on their own, still able to rely on face-to-face contact with a teacher. Blended learning furthermore reduces educational expenses as classrooms are put online. Offering content digitally also helps to drive down budgets for textbooks or other materials.
3. Online learning takes one step further. Here face-to-face sessions with a teacher are no longer. A learners has more freedom here. Self-paced learning means that the student

can start learning at any point in time and has more flexibility to manage his own learning schedule.

Figure 7 in report D3.1 indicates that there is 23% support for complete support through distance learning. Most respondents however opted for partial support (64%). The overall system however should not be restricted however to any of these systems. It must however be clear what technologies are to be used to support either of the scenarios. This chapter lists technologies to support the various universities in implementing part-time and short-cycled education based on the three different clusters.

3.1 Cluster 1: Technologies to enhance face-2-face learning.

The first steps towards the digital enhancement of learning processes is the enrichment of classical face-to-face scenarios. There are little technological constraints for organizing part-time or short-cycled studies in a f2f setting. While traditional face-to-face offers might work well for a local or regional target group, an offer targeted at the whole population could lead to serious constraints related to the necessity to be often on location to follow the offer. Although face-2-face settings can optionally build on a more extensive technology stack, this section presents a minimum of technologies that must be present. To enhance face-to-face settings with digital technologies, the most common approach is to share learning resources (presentation slides, textbooks, links to further information) with the participants to be able to access them independent from time and place. Furthermore, a digital calendar is often implemented that helps learners to oversee the curriculum and course schedules. Sometimes, these two components are complemented with facilities to support the communication between learners. Based on this scenario, we briefly introduce three types of technologies: A document repository, a digital calendar and a forum.

- **Document repository**

A document repository enables both students and teachers to exchange documents. Teachers use this space to share slide handouts, articles or other learning resources to their students. Students can (in the absence of a Learning Management System) post solutions for assignments on this space.

Various cloud-based tools are already available to facilitate this task. Google Drive and Dropbox are well known and enable folder and file synchronisation between desktop, laptop, smartphone or tablet devices. Additionally they enable sharing resources with peers.

This functionality is often integrated with LMS's (cluster 2). This integration lowers the burden of administration such a repository as it is automatically available to all participants of a course. In the case of the Dropbox or Google Drive solution, a teacher must collection e-mail addresses of all students and send them an invitation. Some tools -such as Google Drive- offer the definition of groups. A teacher can then define a group once and authorize google drive access to all users of the group. Other Google apps (e.g. Google Sites) can also be authorized to a group.

- **Calendar**

A calendar service informs students of curriculum timetables, learning events, assignment due dates and other events. In the most simple setting this system allows the teacher to define the various events and distribute them to the system. In more complex cluster 2 and 3 scenario's, these calendars are integrated with the LMS and load e.g. the due dates of assignments.

- **Forum**

A forum is used to enhance communication between students or sometimes also between course lecturers, tutors and students. Sometimes a simple mailing list is also used to ensure that important announcements are received by all participants of the respective study program, cohort or course. Forums are mostly organised according to content-related categories which are sometimes organisational, social or content-related.

3.2 Cluster 2: Technologies for blended learning

The second cluster deals with technologies relevant to support blended learning. Technology must support the combination of face-2-face learning and online, distance education. In such environment text-based, online communication is blended with f2f communication, support for synchronous and asynchronous activities and computer supported interaction is facilitated. Parttime students require flexible learning delivery, therefor asynchronous support of activities is required. Compared to the solutions from the first cluster, digital technologies replace more central processes in the study programs and courses in a blended setting. Note that the details of implementations of blended learning can still have gradual but sometimes also fundamental differences in the intensity that digital technologies are used. A core infrastructure to support a blended learning setting, consist of a learning management system (LMS), basic assessment functionalities and a virtual classroom for tutoring purposes. In addition, a learning analytics infrastructure can complement these technologies, to track learners and inform tutors/teachers about activities and progress of learners.

● Learning management system (LMS)

A learning management system supports organizing, selecting and managing courses and play an important role traditional, blended or online education. Today, many mature commercial and open source solutions are available on the market. It is recommended to adopt a mature LMS such as Moodle or Sakai and to build further on its functionalities. If an institution decides to go along with an open source solution such as Moodle, it is important to either select a service provider that takes care of maintenance and hosting. Alternatively, the institute can govern the platform and reserve resources for hosting and maintenance. Commercial LMS solutions like blackboard nowadays support cloud hosting and can lower the maintenance burden for an institution.

Modern LMS's come with many features and plugins. This sections lists some of the important functions that the PT&SCHE organisations must consider when selecting an LMS. A more comprehensive list has been defined in the E-Learning Framework (JISC). Some sources report other functions being core functions of an LMS. Although these are often important. It is up to the university to take decisions here. Student registration and administration is such an important function. This role might be fulfilled by the LMS. However, often universities use separate tools for this function and implement a connection between the LMS and the student management module.

Course content delivery enables a the delivery of content to students. This can be as simple as structuring rich text, similar to what content management systems do. More advanced systems offer build on standardisation for representing and exchanging this course content. The Sharable Content Object Reference Model (SCORM) is an example of such a standard that enables the creation of units of online training materials.

Optionally, this course content can be enriched by milestones. This requires students to tick off when completing a unit of learning. The Open University of the Netherlands has a positive experience with this kind of milestones. By restricting students to a time path, course dropout has decreased. The disadvantage of this define course content milestones is that student have less flexibility.

Course authoring tools enable define course content and if appropriate defining course content metadata. For example, a course author can define the milestone, that is the date by which a

student must tick off the content. Course metadata can define the conditions for the content is to become visible or it can define whether or not students can comment on the content.

Group discussion or forum activities are important for support asynchronous learning. They increase students engagement and can in a proper learning design trigger students to reflect upon the content, or to react on contributions by peers.

- **Assessment**

Educational assessment documents a learner's knowledge, skills and is often measured through a test. Typically an assessment tools must support both formative and summative assessment. Formative assessment provides the student with ongoing feedback and helps the student to identify whether they are still on track. The goal of summative assessment is to measure a student at the end of a course or at the end of a unit of instruction. This type of assessment can grade the student (e.g. pass/fail). In blended learning settings, summative assessment and grading are often conducted in face-to-face settings since the implementation of this type of assessment in a fully digital setting also requires an authentication method in which the identity of the assessment taker is identified without the potential for fraud.

- **Virtual classroom**

A virtual classroom typically supports more synchronous activities. It can support synchronous instruction by the teacher. In a part time context however, virtual classroom give the student more flexibility. For instance, more flexible assessment is supported by a virtual classrooms. As student can for instance present results of a final assessment to a teacher and peers through a virtual classroom.

Virtual classrooms often come as part of an LMS. Blackboard collaborate is an example of a commercial solution and comes with the Blackboard toolsuite. However more freely available tools such as Google Hangout and Skype are alternatives here.

Important functions for the virtual classroom are:

1. Archiving. When using the virtual classroom to organise an assessment, it is important make the recording persistent.

2. Integration for slides. Both students and teachers using the classroom may want to show slides to the audience.
3. Screen sharing facilities provide the user with even more flexible means to demonstration tools and concepts.

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4. Chat versus webcam presence. Virtual classrooms with larger groups typically degrade when all user use a webcam. The classroom can facilitate this by only offering a selected subset of the users webcam and audio features. The audience can react through chat.

- Learning analytics

In blended and online education, students can work on their own pace. Giving guidance to these student is hard as unlike in a traditional classroom setting, a teacher no longer has visual contact with the students and cannot rely on common senses to see how students are digesting course content. Fortunately e-Learning system generate vast amounts of user data. Learning analytics deals with the use of this learner-produced data to discover information for predicting and advising a student's learning.

(Siemens et al., 2014) present in the LA sophistication model 7 levels of maturity of Learning Analytics developments. Most universities still rely on immature LA solutions that only comprise basic reporting and logging data.

It is recommended to adopt the xAPI standard to capture learning experiences in the learning environment. The Experience API (xAPI) is a specification that describes data about learning events from all sorts of sources. One can thus capture data from various tools including LMS's, virtual classrooms, learning designs and assessments and combine these data. xAPI statements follow a triple structure of "subject-verb-object" and are stored in a Learning Record Store (LRS). Open source as well as more commercial solutions (such as the tincanapi LRS) are available here.

3.3 Cluster 3: technologies for full online learning

This section builds further on cluster 2 and complements it with tools that can be relevant for online learning. In this cluster all processes are available online and all services can be assessed independent from time and location.

- Learning (Activity) Management System

Besides a learning management system and their functionalities as described above, an alternative implementation is a learning activity management system. A learning design details an educational process. Rather than focussing solely on resources, learning designs are pedagogically informed

learning activities. A learning design can be best compared to a script, detailing when the learner should carry out an activity. A Learning Activity Management System (like LAMS) supports defining various activities (assessment, voting, forum, chat, data collection, ...) and in addition defines a learning path. A learning path can lead a student through these activities and can - based on e.g. assessment - present the learner with a more personalised path. In addition, the activity management system should define gates at various points in the learning path. These gates are only open if a learner passes an assessment or demonstrates that he acquired knowledge or skills. ●

Learning design authoring tool

A learning path ties together activities and learning objects with typically a small grained granularity. This authoring tool must allow for the creation of this content and store them in a standardised format e.g. IMS LD or mDita. This tool must allow for editing various kinds of content including rich text, quizzes or media.

- Learning Object Repository

A learning object repository promotes the share and reuse of content. When authoring small grained content, reuse is important. [Verbert et al, 2008] have defined the ALOCOM framework that illustrates this for Powerpoint. Rather storing a Powerpoint presentation as a whole, individual slides are indexed in a repository where they are available for reuse. New slideshows can then be created on the fly through searching and selecting them from the alocom repository. The repository for learning objects can work in a similar way. Users of authoring tool store their fine grained content through a publishing interface (Ternier et al, 2010) in a repository. Through this interface both content as well metadata are submitted to the repository. A search interface as defined by (Simon et al, 2005) gives the user of the authoring tool access to existing, freely available content. It is recommended to store the content in the repository with a license that allows for copying, distribution, editing, remixing and derivatives.

- Assessment and proctoring services

While in the blended mode summative assessment is mostly conducted in a face-to-face setting, in a full online-mode summative assessment is also implemented via digital services. This can entail different modes of summative assessment (as described in the digital classroom) but it also requires that the assessee can be identified without any doubts and that the participation in the assessment is conducted without any possibilities for cheating. For this purpose, recently so called 'proctoring-services' have been developed that use face recognition, typing patterns, authentication and control via Webcam to identify and control the user during assessment and test-situations.

- **Online Tutoring**

In a blended learning model, online-tutoring can complement the support of learners in face-to-face-settings. In a fully online-mode, online-tutoring becomes an essential part to supervise students and lead them through the courses and study programs. Good experiences have been made with a combination of group-tutors that help students to get organised at the entry-phase of a full online-program and content-experts that have expertise in the course content that is offered. For this purpose, a virtual classroom solution or a free-service can be used.

4 Technology options

These different modes for the implementation of PT&SCHE studies lead to the need for institutions to select the appropriate technologies belonging to these recommended categories. In the following table we present example technologies that belong to the categories presented in the three clusters. Actual selection of a specific technologie requires an in-depth study of the contextual requirements by each institution and also an assessment of compliance with national standards (for example related to data security and privacy).

Mode	Category	Example software	Comments
Online			
	Learning Activity Management	OpenSource: LAMS	
	Content authoring tools	OpenSource: mDita, H5P	
	Learning Object Repositories	ARIADNE, LRE, Dspace, Fedora	

	Assessment and proctoring services	Comprobo, Smowl, TestReach	
	Online-tutoring	Youlearn	
	services		
Blended Learning			
	Learning Management System	OpenSource: Moodle, ILIAS, Youlearn Commercial: Blackboard, Itslearning,	
	Assessment	QuestionMark, Yardstick	
	Virtual Classroom	BigBlueButton	
	Learning Analytics	Learning Locker	
Enhanced F2F			
	Document repository	Google Drive, Dropbox	
	Calendar	Google Calendar, Basecamp	

	Forum	Google Groups, phpBB, bbPress	
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5 Recommendations for deployment of an infrastructure

Depending on the selection that each partner takes for the infrastructure for PT&SCHE studies, there are several options for collaboration that have the highest chances to be sustainable and efficient. For commercial solutions, it is advisable to establish a consortium that is able to negotiate licensing fees together. For an open source solution it is advisable to establish an organisation that jointly cares for maintenance, security and further development of the tools or infrastructure. Such an organisation can also deliver the benefit to share costs between the partners and to jointly decide on a development agenda. For the deployment of an infrastructure, the governance, the execution and the formal documentation are utmost important.