

# ADVANCEMENT OF E-PORTFOLIO SYSTEM TO IMPROVE COMPETENCE LEVELS

## **ePortfolio sistēmas pilnveidošana kompetenču līmeņu paaugstināšanai**

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**Abstract** – Nowadays educational process is not imaginable without applications of information technologies. Their implementations in different technology enhanced learning programs, platforms and systems are becoming more and more popular in educational institutions all over the world. Appropriate usage of information systems has already gained significant place in curriculums and learning processes. However, due to rather high drop-out rate and insufficient learning outcomes educational organisations are still seeking for new systems, tools and methods which would enhance learners' competence development. This paper describes benefits of a new ePortfolio system created by Riga Technical University's researchers group, its testing results in Living Lab environment in study year 2012/2013, and comparative analysis with initial version of the system implemented in previous year. Findings show that introduced new ePortfolio system has a great positive impact on learning outcomes and learners' competence development.

**Keywords** – competence, ePortfolio system, collaborative learning environment, critical thinking, reflection, assessment.

## **Introduction**

What ought to be done to improve learning outcomes and make knowledge acquisition process more engaging, motivating and effective? That is not a secret that nowadays educational process is not imaginable without information technologies. Their implementations in different technology enhanced learning programs, platforms and systems are becoming more and more popular in educational institutions all over the world. Appropriate usage of information systems has already gained significant place in curriculums and learning processes (Jirgensons, 2012). However, due to rather high drop-out rate and insufficient learning outcomes educational organisations are still seeking for new innovative systems, tools and methods which would enhance learners' competence development.

There were many attempts to improve knowledge acquisition process. Thus, Whitehead's basic method of the living theory approach in education, which stated that everybody might have own problem solving explanation, and this might influence person's learning process (Whitehead, 2009), was developed further by Janis Kapenieks (sen.) who has implemented action research as a collaborative study method for university students. Google Docs application was used to find out learners' creativity abilities and anxiety for knowledge – he expected that action research method will facilitate creating of living theory by learners and more successful students might encourage other group students to enable their creativeness. It was found that the creativity in students' actions led to knowledge creation (Kapenieks, 2011).

The role of assessments also is highly important. Self-assessments, peer-to-peer and group assessments in higher education have been more and more supplementing traditional, wide used in secondary schools, tutor made assessments. Sometimes educators make a muddle of assessment issue and wrongly substitute the assessment as a learning goal

achievement tool to the assessment as a process (Race, 2001). Competence assessment should be always tailored with competence development activities, thus leaving out the possibility of learners having their competencies assessed without entering competence development activities (Baartman et al., 2006). During and after assessments tutors ought to monitor the process, lend assistance to learners, analyse, work on amendments, and develop learning outcomes' improvement program. The use of peer and self-assessments should be recognised as competence development in itself (The University of Exeter , 2011).

Implementation of assessment tools in various educational information systems can perfect goals of assessments. ePortfolio system might be accepted as an expedient environment for assessment tasks implementation and engaging learners in knowledge acquisition, critical thinking and reflection processes. Nowadays ePortfolios show two faces: they are changing from simple show-case models to process oriented systems which are becoming more important components in educational process (Barrett, 2009). Main essence and feature of these ePortfolio systems is in reflection on evidence (Lyons, 1998). Reflection, and particularly – reflective writing, ought to be considered as analytical and creative process which facilitates comprehensive sense of the case (Jasper, 2006). Universities are trying to improve their curriculums, educational methods and tools. Despite some progress in this field, a necessity of creating an effective information system, which would enhance learners' competence developments, still exists.

## **Background**

To enhance learners' competence development and improve their learning outcomes, for the first time an appropriate information system prototype based on ePortfolios solutions was created and tested in Living Lab environment at the Riga Technical University in study year 2011/2012. For testing purposes existing blended learning course „Business Planning for Open Markets” (further – BPOM) was rebuilt. The first year bachelor study programme students were tasked to do five homework tasks in established sequence, submit them and take part in ePortfolio group-working activities. Based on critical thinking notes made by ePortfolio group members, system users were encouraged to reflect on these suggestions and improve their initial submissions (Gorbunovs et al., 2012).

In addition to that, students had to fill in self-assessment questionnaire eight times during entire course. The reason to do so was: for students – to check own study progress, find the gaps and get motivation; for teaching staff – to monitor students competence developments at each stage of the course and analyse course modules' impact on these advancements (Gorbunovs et al., 2012).

For the first two tasks ePortfolio groups, four students each were formed based on the sequence of homework submission. From the second group-working activity till the end of the course groups remained unchangeable. As each of homework tasks was built on previous one (Gorbunovs et al., 2012), it was assumed that being kept in the same group its members would better known colleagues' homework developments inside out. Prototype testing displayed rather good positive correlation between achieved competence levels and learners' activities within ePortfolio system (Gorbunovs et al., 2012). For instance, students exam results correlated with their activities within the system, i.e. fulfilled ePortfolio group-working tasks ( $r=0,475193139618558$ ). Based on this, we have concluded that 22,58 per cent of the learners success was directly attributable to the usage of experimental information system (coefficient of determination  $r^2= 22,58085199405424$ ).

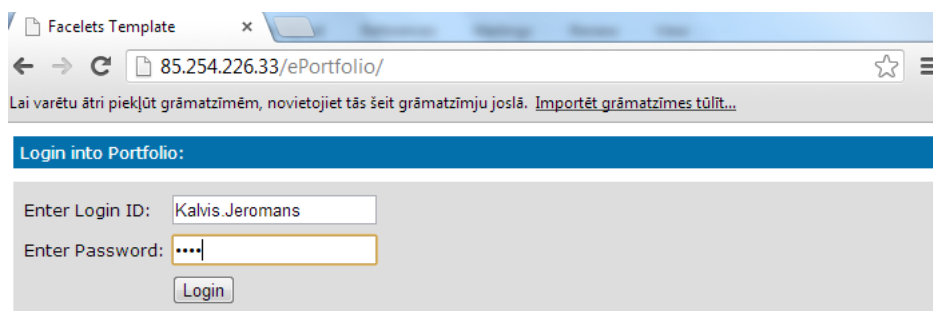
Despite achieved results during testing of experimental ePortfolio system prototype, we were concerned about rather high drop-out rate within all first year bachelor study programme students which had a negative effect on a quantitative structure of ePortfolio groups. Thus, some groups lost one to three (from totally four) their members. Accordingly,

the quality of group-working activities within ePortfolio system did not meet the best available expected level. Against this background, it was considered that created system might be changed to improve anticipated learning outcomes. Namely, to ensure ePortfolio groups powerful and divert a decrease of their quantitative structure, the development of improved ePortfolio system was proposed.

## Tools and Methods

New ePortfolio system development and its testing was organized for „Business Planning for Open Markets” (further – BPOM) course bachelor study programme students by the Distance Education Study Centre, Riga Technical University, in the autumn semester of study year 2012/2013, from September 3, 2012 to January 25, 2013. Similarly to the first ePortfolio system model the new one also provided collaborative environment where learners were encouraged assess others in five group-working activities, think critically and reflect on peer’s suggestions and written evidences.

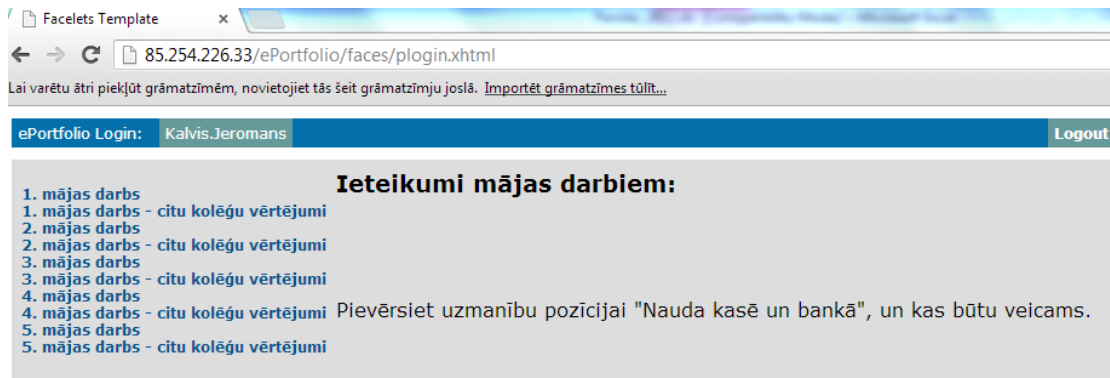
An access to ePortfolio groups and assessment tasks was available both from BPOM course page in the Riga Technical University’s study portal “ORTUS” Moodle environment and independently, by filling in ePortfolio URL (<http://85.254.226.33/ePortfolio/>) in a Web browser’s toolbar. Each time when users reached the system, an activation of their actions started from an authentication and authorization, and in the user’s profile learners were asked to enter their login identification and password (Fig.1).



**Figure 1. ePortfolio system login page**

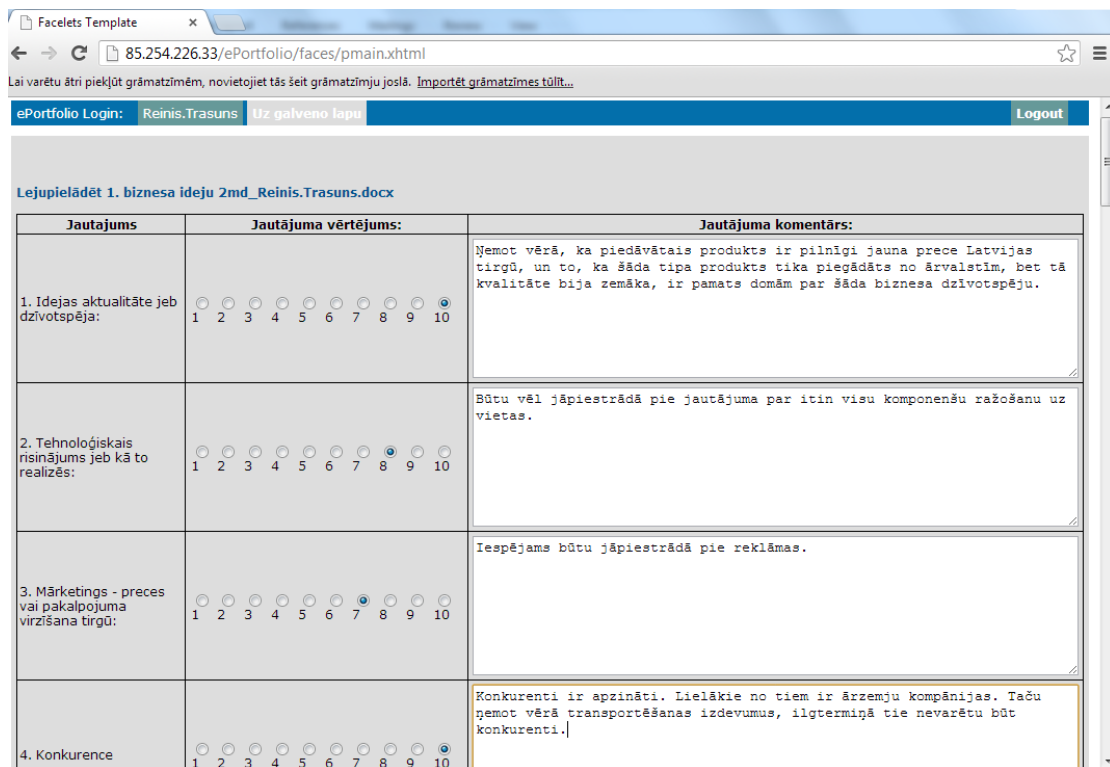
After authentication and authorization procedures users were able to open ePortfolio user’s desktop (Fig.2). The desktop invited learners to proceed to the system’s collaborative environment – for group-working activities (in Fig.2 – links “*1.majas darbs*”, “*2.majas darbs*” and so on), check and reflect on ePortfolio group members remarks and critical thinking notes related to his/her accomplishments (in Fig.2 – links “*1.majas darbs – citu kolegu vertejumi*”, “*2.majas darbs – citu kolegu vertejumi*” and so on), and take into account tutor’s suggestions (in Fig.2 – the sentence on the right from the link “*4.majas darbs – citu kolegu vertejumi*”).

In ePortfolio system’s collaborative environment (Fig.3) the student had to download group participants’ homework files, then assess them in marks from 1 to 10 (where 1 corresponded to the worst mark and 10 – the best one), and write in comments (critical thinking notes and remarks) regarding the issue. After completion of one homework assessment ePortfolio system user had to submit results to the data base by pushing button “Save” and start other homework assessments. This requirement applied also on own homework evaluation to motivate learners think critically and reflect on suggestions.



**Figure 2. ePortfolio user's desktop**

In ePortfolio feedback area students had an availability to acquaint themselves with critical thinking remarks made by assigned group members (Fig.4). This opportunity played one of the most significant roles to activate learners' critical thinking and reflection. Based on that, students got better understanding about the weakest chains in their homework constructions and critical areas in their business plans. Accordingly, ePortfolio group participants' attitude had an effect on further homework developments and improvements.



**Figure 3. ePortfolio collaborative environment**

The novelty in our approach, methods and tools, in comparison with previous ones (Gorbunovs et al., 2012), were some changes in principles of ePortfolio group formation and the system's ability to form these groups automatically. Every time when a new homework task was announced, and students submitted their appropriate homework files, the ePortfolio system formed groups of four persons each anew. It means that all created groups for corresponding module task were made complete.

Biznesa idejas autors:	Biznesa idejas vērtētājs:	Jautājums:	Jautājuma vērtējums:	Jautājuma komentārs:
2md_Kalvis.Jeromans.doc	Kalvis.Jeromans	1. Idejas aktualitāte jeb dzīvotspēja:	8	
2md_Kalvis.Jeromans.doc	Kalvis.Jeromans	2. Tehnoloģiskais risinājums jeb kā to realizēs:	7	
2md_Kalvis.Jeromans.doc	Kalvis.Jeromans	3. Mārketing - preces vai pakalpojuma virzīšana tirgū:	7	
2md_Kalvis.Jeromans.doc	Kalvis.Jeromans	4. Konkurence	9	
2md_Kalvis.Jeromans.doc	Kalvis.Jeromans	5. Finanšiālais nodrošinājums:	7	
2md_Kalvis.Jeromans.doc	Kalvis.Jeromans	6. Uzņēmuma spēja realizēt ideju:	7	
2md_Kalvis.Jeromans.doc	Kalvis.Jeromans	7. Iespējamie riski:	4	Liels risks ka studenti neizjūtīs šīs aplikācijas vajadzību!
2md_Kalvis.Jeromans.doc	Matiss.Janusevsk	1. Idejas aktualitāte jeb dzīvotspēja:	8	Ļoti noderīga aplikācija, iespējams šī ideja varētu nākotnē īstenoties
2md_Kalvis.Jeromans.doc	Matiss.Janusevsk	2. Tehnoloģiskais risinājums jeb kā to realizēs:	8	Nav nekā sarežģīts, vajadzīgi tikai speciālisti ar programmēšanas un dizainēšanas prasmēm
2md_Kalvis.Jeromans.doc	Matiss.Janusevsk	3. Mārketing - preces vai pakalpojuma virzīšana tirgū:	7	Nezinu vai studenti vēlētos pirkt šo aplikāciju, jo tā maksā naudu un ir pieejams daudz līdzīgas aplikācijas, kā piem android RTU stundu saraksts un tas ir par velti, bet par to ir padomāts, ja šo programmu 1. mēnesī varēs lejupielādēt par velti
2md_Kalvis.Jeromans.doc	Matiss.Janusevsk	4. Konkurence	9	Konkurences principā šādai idejai pagaidām nav
2md_Kalvis.Jeromans.doc	Matiss.Janusevsk	5. Finanšiālais nodrošinājums:	8	Tas nav vajadzīgs liels
2md_Kalvis.Jeromans.doc	Matiss.Janusevsk	6. Uzņēmuma spēja realizēt ideju:	10	Šo ideju ir pavisam reāli realizēt
2md_Kalvis.Jeromans.doc	Matiss.Janusevsk	7. Iespējamie riski:	6	Risks ir tāds, ka studenti nevēlēšies izdot naudu pa ršādu aplikāciju, jo ir alternatīvas, protams ne tik labas kā šī ideja, bet tomēr ir.

Figure 4. Critical thinking remarks

Teaching staff had an access to all data of students' activities within ePortfolio system to monitor on-going learning process and detect possible gaps. Besides, we developed and implemented additional system's tools which allowed tutors reviewing of users ePortfolios, notes-taking and sending necessary recommendations to students with immediate appearance on ePortfolio user's desktop (Fig.2). Figure 5 shows an example of tutor's recommendation page where the tutor has sent remarks and recommendations to different students regarding their homework performance level, mistakes and possible further improvements.

Lietotāja vārds:	Ieteikums biznesa idejai:	Ieteikums biznesa plānam:	Ieteikums md3	Ieteikums md4	Ieteikums md5	Saglabasana
Juris.Kudins	Kad plānojat iesniegt 1.mājas darbu?					Save
Juris.Truss		Parādīet, ar ko Jūs varētu pārsteigt konkurentus.	Tebulā jābūt vismaz 3 ienēmumu veidiem	Pārbaudiet uzņēmuma maksāto peļņas nodokli.	Pārīkvojiet savus aprēķinus! Balances daļā pasiviem jābūt vienādiem ar aktīviem!	Save
Juris.Vanids	Vai būtu labi izanalizēt šīs kompānijas neveiksmīgu cēloņus.		Ja Jūsu firma komplektē datorus, tad papildus varat atrast vēl virkni citu pozīciju, kur gūt ienēumus (atļaujināšana, programmatīvas apkalpošana, sava	Kur paliks EVN aprēķini? Aizpildiet atbilstošās ailes nodokļu sadaļā.	Lūdzu ierasties uz konsultāciju 228.telpā šo pirkdienu no plkst. 16:00 līdz 19:00.	Save
Kalvis.Jeromans				Pievērsiet uzmanību pozīcijai "Nauda kasē un bankā", un kas būtu veicama.		Save

Figure 5. Tutor's recommendations page

To monitor students learning progress and analyse ePortfolio system, course themes' and modules' impact on individuals competence development, in this research we kept self-appraisal system in the university's study portal "ORTUS" (Gorbunovs et al., 2012) – in parallel to assessment one in the introduced ePortfolio system.

## Results

189 first year bachelor study programme students of the Riga Technical University started the BPOM course. Only 109 learners reached final exam. Due to some faults in their assessment forms we consider to analyse only data of 99 persons' results which were acknowledged as valid ones.

Testing results in Living Lab show that new ePortfolio system has positive impact on users' competence development and learning outcomes. During the course students acquired new themes, analysed peers accomplished tasks within ePortfolio system, cogitated, reflected on critical thinking remarks, written evidences, and, as a result, many of them made significant progress and improved own homework papers.

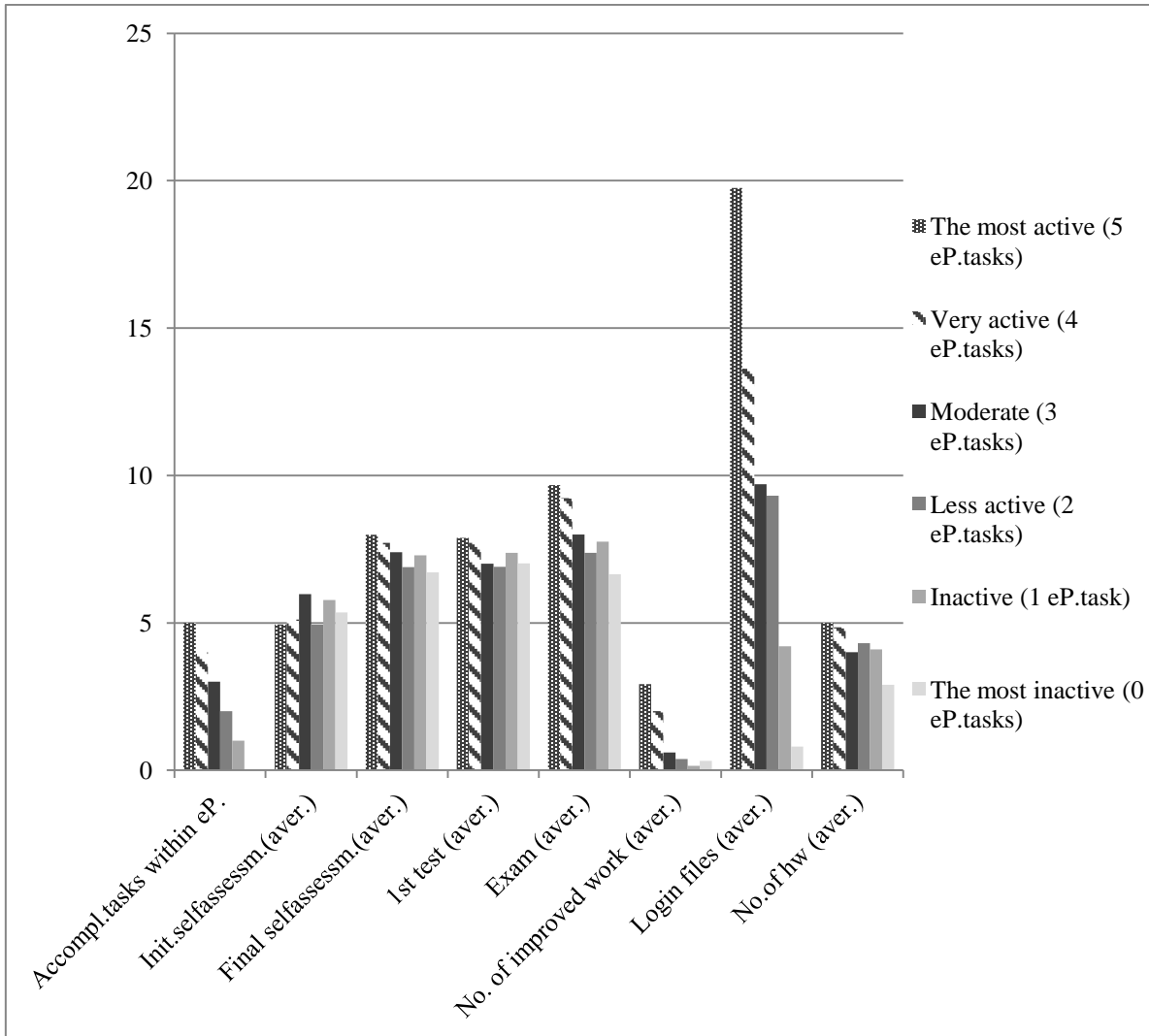
Analysing learning outcomes depending on students' activities within ePortfolio system (Table 1 and Figure 6) we can conclude, that serious attitude against entrusted group-working tasks and conscientious participation in ePortfolio system collaborative environment let learners succeed better learning outcomes and higher competence levels. So, those persons, who took part in all five group-working activities within ePortfolios, achieved 1,45 times better exam results rather than students who ignored collaborative ePortfolio system environment. Even better this difference is observable when we count number of improved homework files – the most active ePortfolio system users made 9,13 times more improvements in comparison with students who did not use the system.

**Table 1. Learning outcomes depending on activities within ePortfolio system (on aver.)**

Fulfilled eP. tasks (activities)	Initial self-assessm.	Final self-assessm.	1 <sup>st</sup> test	Exam	Improved works	eP. login files	Fulfilled homework tasks	No. of learners
5	4,94	7,99	7,88	9,67	2,92	19,75	5,00	12
4	5,11	7,71	7,71	9,23	2,00	13,62	4,85	13
3	5,97	7,40	7,01	8,00	0,60	9,70	4,00	10
2	4,94	6,89	6,90	7,38	0,38	9,31	4,31	13
1	5,77	7,29	7,38	7,75	0,15	4,20	4,10	20
0	5,35	6,71	7,02	6,65	0,32	0,80	2,90	31

It could be also concluded that activities within ePortfolio system motivate learners to develop further their competencies. Thus, an average number of fulfilled homework tasks of those students, who were not engaged in ePortfolio group-working activities, was 1,72 times less than active ePortfolio system users showings.

Retracing ours steps to homework improvements it could be important noticing of a fact that there were submitted several improved homework files which were done by inactive and the most inactive ePortfolio system users (correspondingly, with one or no accomplished tasks within the system). Despite low activity level they had the time to login into the system and check their group participants' opinions and remarks related to submitted homework files. Accordingly, we have got on average 0,32 improvements amid students who did not accomplish any of ePortfolio tasks (with 0,80 ePortfolio login files), and 0,15 improvements amid students who accomplished only one ePortfolio task (with 4,20 ePortfolio login files). Based on this, we can claim that introduced ePortfolio system aids learners also in those cases when their level of activity and engagement into learning process is rather low.



**Figure 6. Learning outcomes depending on activities within ePortfolio system**

Exam results, which in this case we consider as users' achieved competence levels (due to examination process and conditions which require students demonstrate a cluster of related abilities, commitments, knowledge, and skills (BusinessDictionary.com, 2013) during presentation and defending of their course-paper – business plan), have rather good correlation with activities within ePortfolio system, i.e. fulfilled group-working tasks ( $r=0,564666916435365$ ), moderate correlation with a number of ePortfolio login files ( $r=0,393296887066404$ ), final self-assessment results ( $r=0,392292517069791$ ), and satisfactory correlation with a number of improved homework ( $r=0,324090850968053$ ).

These correlation coefficients become even stronger if we eliminate the data of three students who did not pass final exam. Hereby, ePortfolio system users' achieved competence levels have strong correlation with fulfilled group-working tasks within the system ( $r=0,665499248756715$ ), rather good correlation with a number of ePortfolio login files ( $r=0,478298457550597$ ), final self-assessment results ( $r=0,472116734391034$ ), and moderate correlation with a number of improved homework ( $r=0,40991149628112$ ). Based on this, it could be concluded that 44,29 per cent of the learners success was directly attributable to the usage of experimental information system (coefficient of determination  $r^2=0,442889250095752$ ). This percentage let us to claim that new ePortfolio system is more effective than previous system prototype introduced in study year 2011/2012. Besides, it was

found that the correlation between achieved competence levels (exam results) and activities within ePortfolio system was about two times stronger than the correlation between achieved competence levels and fulfilled homework tasks outside ePortfolios.

It might be asked whether ePortfolio system users' success turns on their activities or prior competencies. Based on determination coefficient of initial test and exam results ( $r^2=0,0523722830329603$ ) we can say that only 5,24 per cent of the learners success was directly attributable to their prior level of competencies; thus, this indicator has feeble impact on achieved competence levels at the end of the course (beyond compare less than the usage of ePortfolio system).

## **Conclusions**

New ePortfolio system has a great positive impact on learning outcomes and learners' competence development. Activities within the system engage learners into group-working, activate their critical thinking skills and reflection. The system facilitates collaboration between students. Active ePortfolio system users are able to improve their competencies and initial homework submissions much better than their less active or even inactive peers. As a result, they achieve better learning outcomes and higher competence levels; besides, prior competence levels have not considerable effect on competence enhancement and final results.

Living Lab experiments show new ePortfolio systems upper hand on previous one. Despite acceptable good results in testing of previous ePortfolio system prototype in 2011/2012, the new information system has almost two times better efficiency showings. It justified our assumptions that group formations ought to be made anew for each task or course module to avoid group frustration.

Overall, it could be expected that learning outcomes will become better if participation in ePortfolio all group-working activities (tasks) sets as a mandatory course requirement. At the moment, participation in activities within the system is voluntary for students; and as a motivating instrument there may serve significant positive ePortfolio system usage results.

## **Acknowledgement**

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## **Kopsavilkums**

Rakstā tiek sniegti pētījumu rezultāti par tādas informācijas sistēmas izveidi, kas sekmētu tās lietotāju kompetenču celšanos. Kā iespējamais risinājums tiek piedāvāts Rīgas Tehniskajā universitātē (RTU) izveidotās ePortfolio sistēmas pilnveidotais prototips. Tiek analizēti šīs sistēmas pielietošanas rezultāti izglītojamo (RTU Elektronikas un telekomunikācijas fakultātes bakalaura studiju pirmkursnieku) kompetenču izaugsmes veicināšanai 2012./2013. studiju gadā, kā arī tās efektivitātes salīdzinājums ar sistēmas sākotnējo versiju, kas tika izmēģināta Living Lab apstākļos 2011./2012. studiju gadā.

Konstatēts, ka izveidotā ePortfolio sistēma sekmē būtisku kompetenču līmeņa celšanos, un 44,29 procenti no izglītojamo sasniegumiem tieši saistīti ar darbību šajā informācijas sistēmā. Pilnveidotā ePortfolio sistēma efektivitātes (tās ietekmes uz kompetenču izaugsmi) ziņā 1,96 reizes pārsniedz gadu iepriekš izveidoto sākotnējo tās versiju.

Novērota stipra korelācija starp studentu sasniegtajiem kompetenču līmeņiem un izpildīto grupu darbu skaitu ePortfolio sistēmā ( $r=0,665499248756715$ ), kā arī vidēji stipra

korelācija starp sasniegtajiem kompetenču līmeņiem un ePortfolio login failu skaitu ( $r=0,478298457550597$ ), nobeiguma pašnovērtējumu ( $r=0,472116734391034$ ) un uzlaboto darbu skaitu ( $r=0,40991149628112$ ).

Tiek veikts pieņēmums, ka ieviešot nosacījumu par ePortfolio sistēmas obligātu pielietošanu studiju procesā (līdz šim brīdim darbībai ePortfolio sadarbības vidē bija tikai ieteikuma raksturs), šīs sistēmas efektivitātei vajadzētu pieaugt.

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