PROFESSIONAL DEVELOPMENT OF SCIENCE AND MATHEMATICS TEACHERS FOR BUILDING STUDENT DIGITAL COMPETENCE: EXPERIENCE OF LATVIA

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REPUBLIC OF LATVIA

Capital and largest city
RIGA

Official language
Latvian

Area:
64 589 km²

Population (2016):
1 953 200

UNIVERSITY OF LATVIA

ANNO 1919

13 faculties

≈ 14 000 students

Studies and research in
- humanities
- pedagogy
- social sciences
- natural sciences
- health sciences

LATVIJAS UNIVERSITATE
ANNO 1919
UNIVERSITY OF LATVIA

Over 20 research institutes and independent study centers

INTRODUCTION

- Digital competence: the set of knowledge, skills, attitudes that are required when using ICT and digital media to perform different tasks. (Ferrari, 2012)
- Teachers professional performance: using ICT with effective teaching strategies to expand learning opportunities and content knowledge for all students. (AITSL, 2011)

ESF DEVELOPMENT PROJECTS IN SCIENCE AND MATHEMATICS IN LATVIA

Science and math I
Upper secondary level
2005 – 2008

Science and math II
Lover secondary level
2008 – 2011

Developed the subject
- standards (goals and outcomes)
- curriculum and syllabi (methodological approaches and strategies)
- teacher support materials (adapted to the new curricula)

Supplied schools with:
- Equipment for science classrooms (included ICT)
- Methodological support materials

Organised professional development classes for teachers

Complete set of materials for grade 10 to 12

2005 - 2008

Complete set of materials for grade 7 to 9

ESF DEVELOPMENT PROJECT IN EDUCATION IN LATVIA

Implementation of competence - based education

2016 – 2020

Latvijas Universitātes Starpnozaru izglītības inovāciju centrs

Center for Science and Mathematics Education Research

2013 – 2016

- Gap between policy and actual teaching approaches
  (France, Namsone & Čakāne, 2015; Volkinsteine & Namsone, 2016)
- Direct impact on practices

RESEARCH QUESTIONS:

- What stages can be identified in teacher professional development on the focused area: building of student digital competence in Latvia over period of 10 years?

- What should the next stage CPD model of building student digital competence be like?

RESEARCH QUESTION 1

What stages can be identified in teacher professional development on the focused area: building of student digital competence in Latvia over period of 10 years?

Data collection and analysis:

- analysis of continuing professional development (CPD) programs (2006 – 2008; 2009 – 2011)
- 64 science lesson observations and analysis (2013 – 2014)
- analysis of expert feedback (2013 – 2014)

Professionally trained experts from the Center for Science and Mathematics Education (10 – 15 years experience)

RESULTS AFTER ANALYSIS OF CPD PROGRAMS

Criteria	Stage I (15 h out of 72)	Stage II (6 h out of 36)
Usage of ICT tools and resources	To acquire the technical skills to use various ICT tools: - data loggers, sensors, interactive whiteboard, web camera, data camera etc. Teachers identify the resources available for the organization of the teaching/learning process in science and math: - videos, virtual labs, animations etc.	To use the developed teaching materials, ICT tools and resources in the teaching/learning process (mostly in Latvian): - lesson plans - Worksheet for virtual labs etc. animations To learn from other colleagues` 'best practice' examples. Students identify the resources available for the learning process in science and math: - videos, virtual labs, animations etc.
	Basic learning model	**Support system model**
The aim of teaching/ learning	To use ICT in the teaching/learning process - for visualization - to demonstrate content to students - to deliver information	To develop and enhance ICT skills for organizing the teaching/learning process: - to plan according to the achievable outcomes - to engage students with content - to facilitate collaboration during and beyond lessons

LESSON OBSERVATIONS AND ANALYSIS

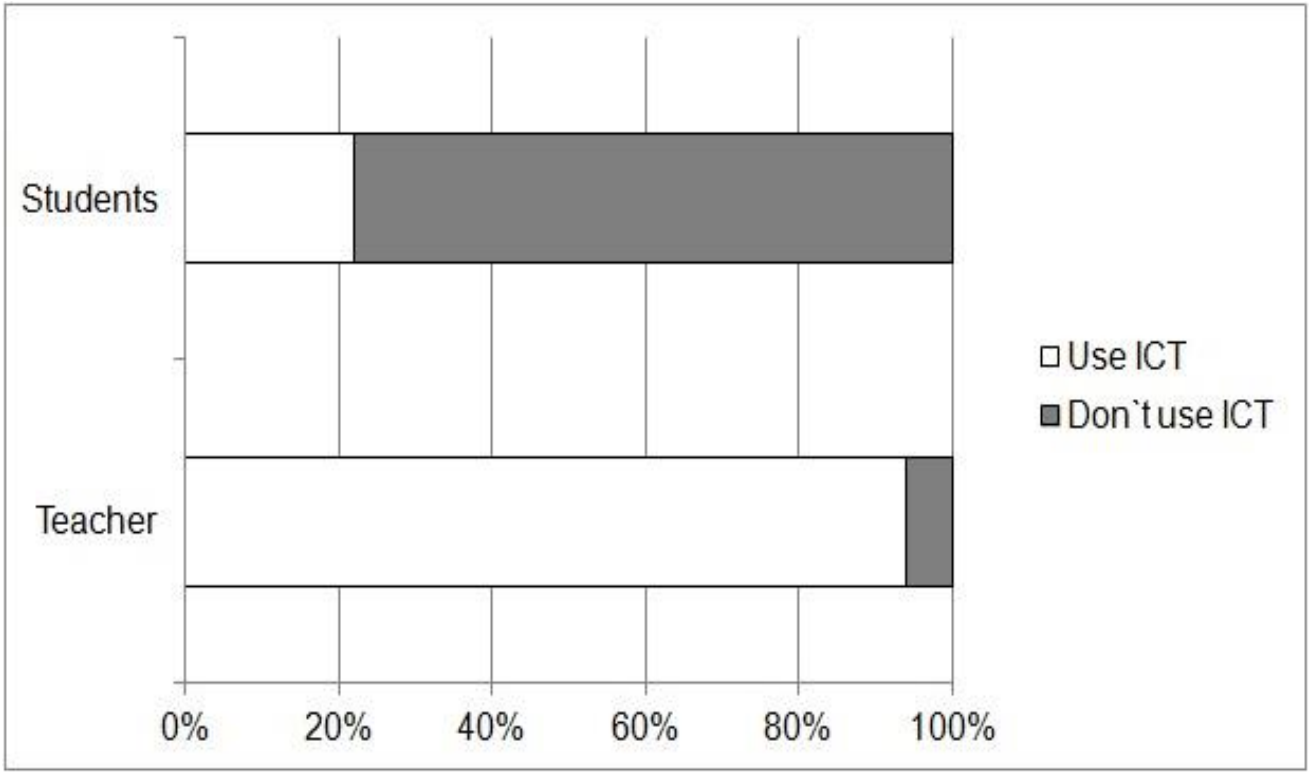
- 2013 - 1014
- 10 schools from the same municipality
- 64 science subject lessons (physics, biology, chemistry; grades 7 – 12)
- Teachers have completed CPD classes offered by projects “Science and Math”

Data collection and analysis:

- Specially developed e-observation sheets for transcript and analysis
- Rubric: use of ICT for Learning

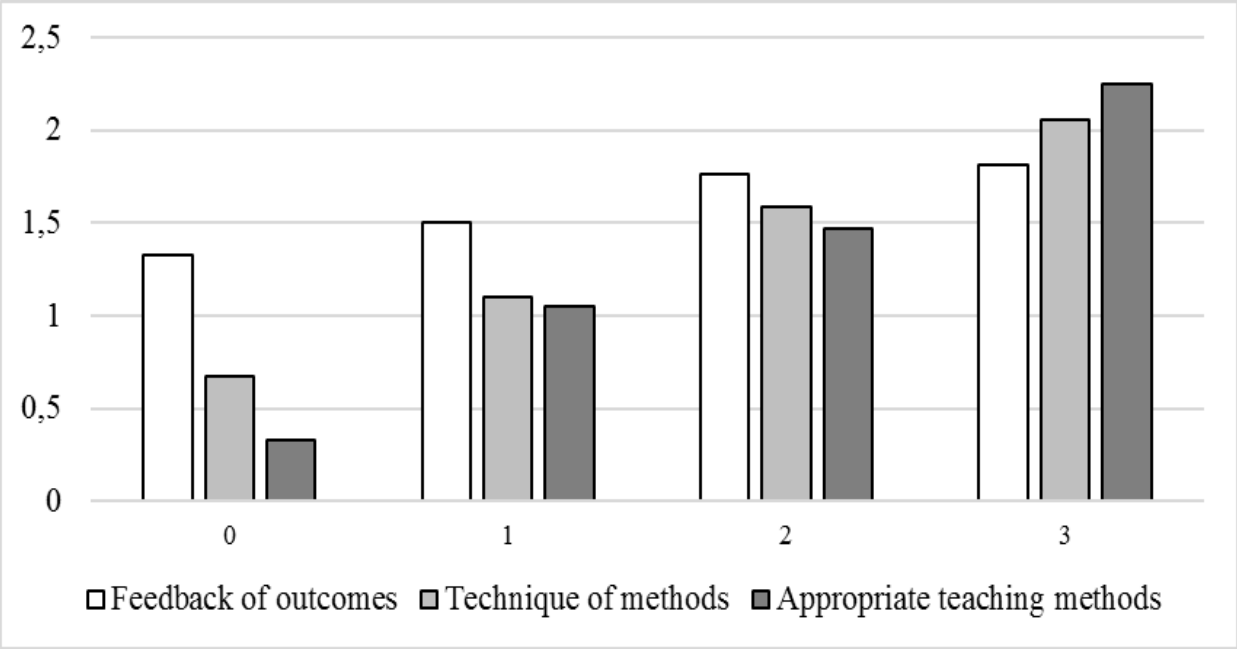
RESULTS AFTER LESSON OBSERVATIONS AND ANALYSIS

The use of ICT tools in science lessons



RESULTS AFTER LESSON OBSERVATIONS AND ANALYSIS

The correlation between the use of ICT and implemented teaching methods



0 – not present; 1 – minor presence; 2 – moderate presence; 3 – present

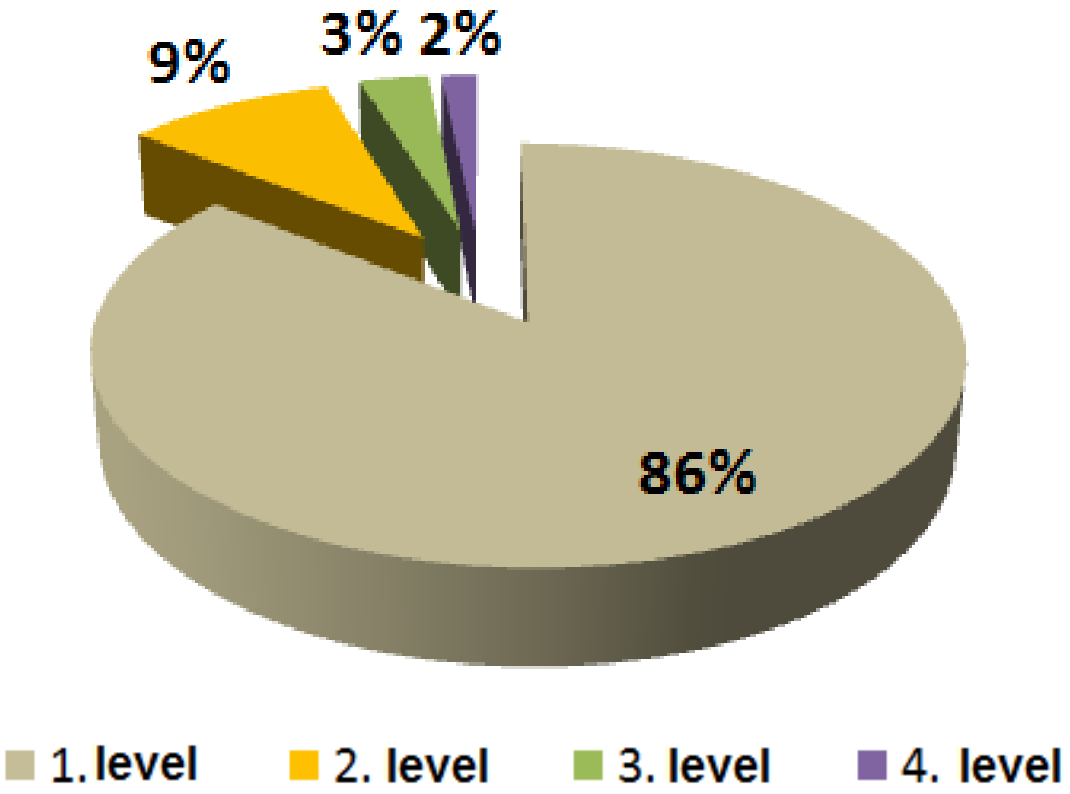
RUBRIC: USE OF ICT FOR LEARNING

Level	Criteria
1	Students do not have the opportunity to use ICT for this learning activity
2	Students use ICT to learn or practice basic skills or reproduce information. They are not constructing knowledge.
3	Students use ICT to support knowledge construction BUT they could construct the same knowledge without using ICT.
4	Students use ICT to support knowledge construction. AND the ICT is required for construction this knowledge. BUT students do not create an ICT product for authentic users.
5	Students use ICT to support knowledge construction. AND the ICT is required for construction this knowledge. AND students do create an ICT product for authentic users.

CLD Learning Activity Rubrics. Microsoft Partners in Learning

RESULTS AFTER LESSON ANALYSIS

Usage of ICT in science lessons according to the rubric criteria



Discussion and conlusions I

- In teacher professional development on the focused area: building of student digital competence in Latvia over period of 10 years we can identify two stages: 1) teachers acquire the technical skills of using ICT (basic learning model); 2) teachers develop and enhance ICT skills for organizing the teaching/learning process (support system model).
- The observed lessons allowed us to detect the presence of ICT in teaching and learning process compared to 2006 when it was virtually non-existent in Latvia.

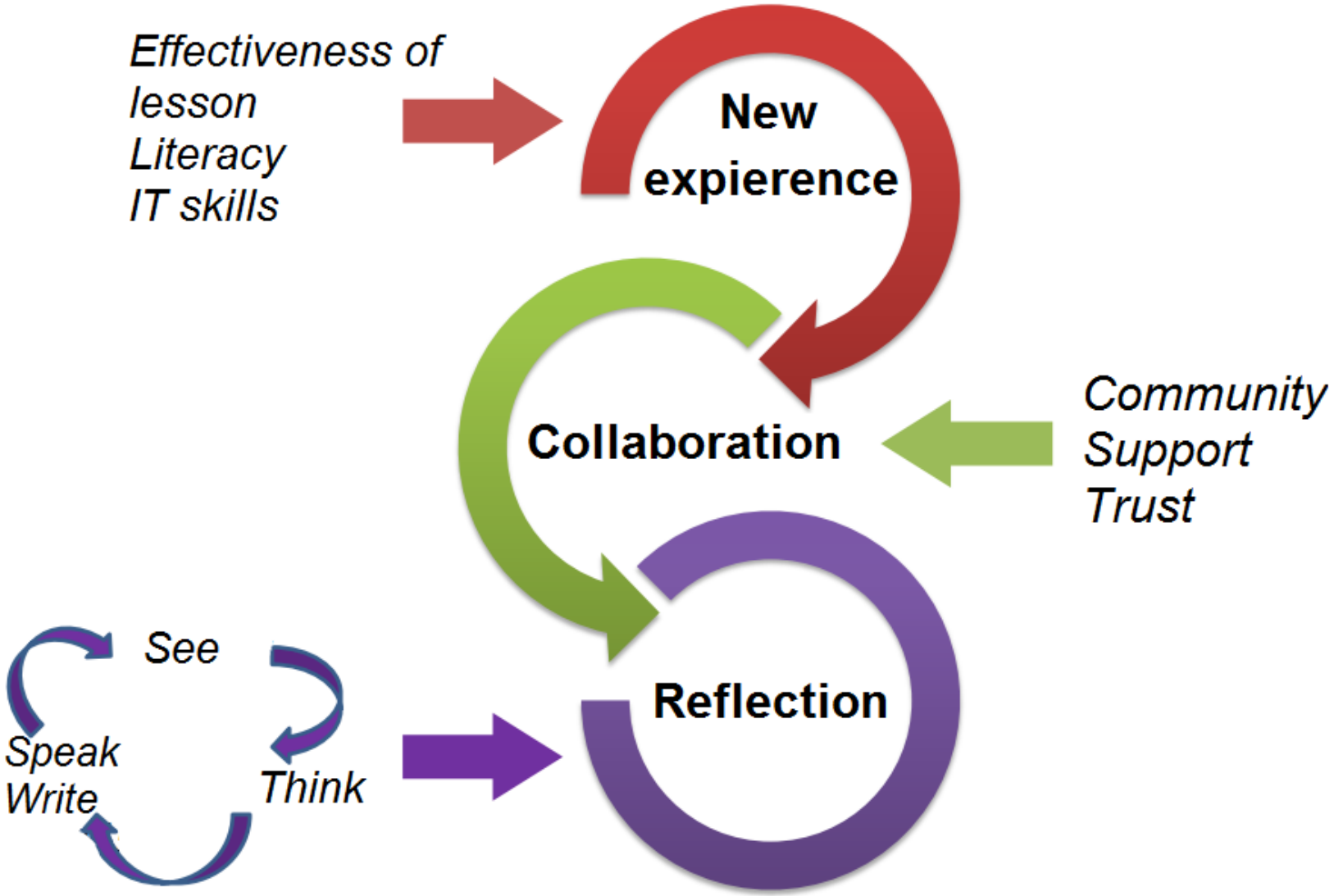
Discussion and conclusions II

- The use of ICT in the classroom will be meaningful if the teacher has the appropriate skills that allow him/her to choose the most efficient method for the lesson, and if the teacher knows how to apply this method in order to achieve the goals.

- Lesson observations in Latvia reveal a gap between policy and actual teaching approaches:
    - ICT is still mainly used by teachers as a tool for transmitting information and the involvement of students in the application of ICT is low.

- Should be offered a new model of CPD for teachers.

LEARNING PHYLOSOPHY



RESEARCH QUESTION 2

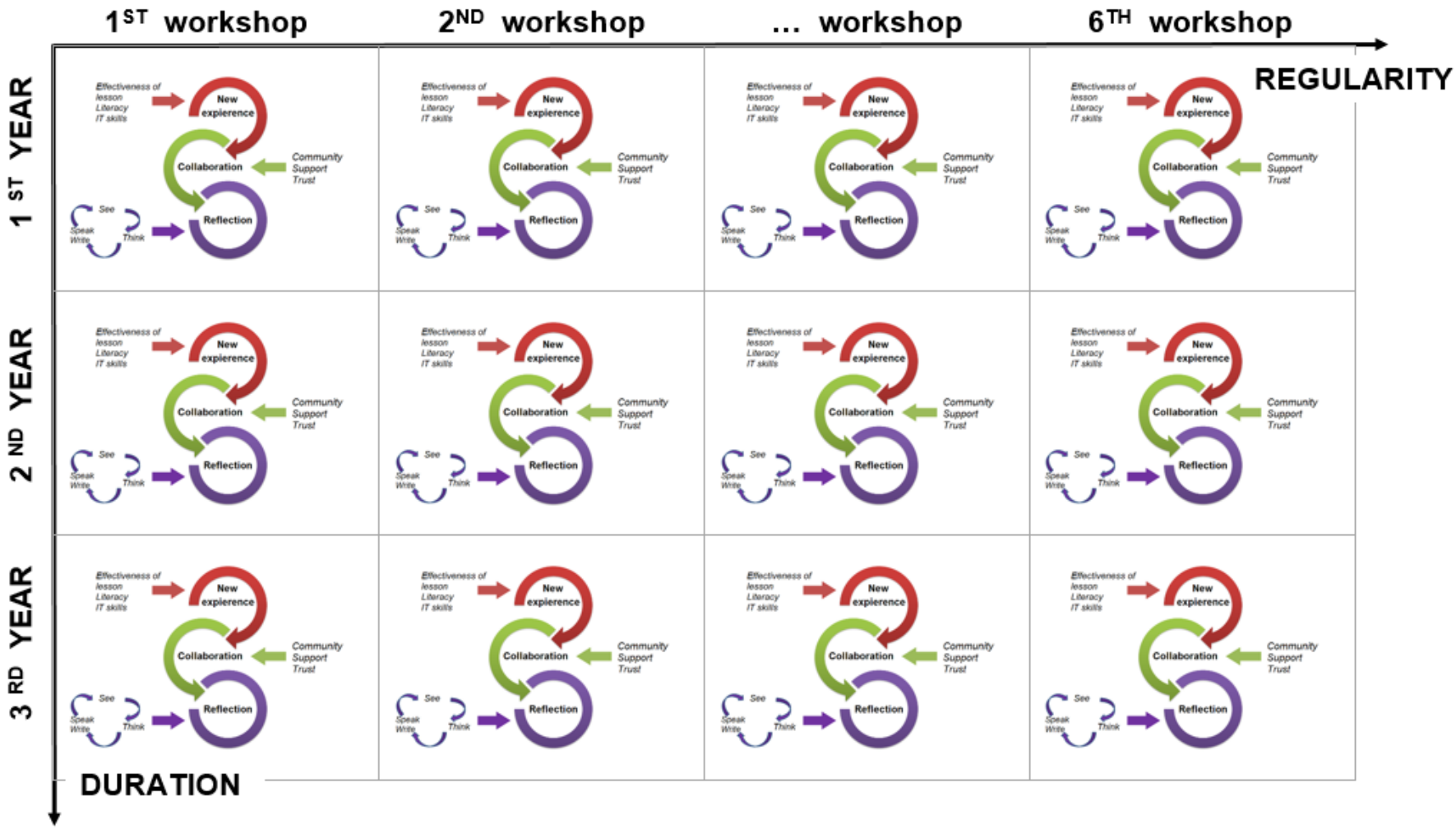
What should the next stage CPD model of building student digital competence be like?

Participants

Group of 35 science and mathematics teachers

- have completed CPD classes offered by both projects «Science and math I & II»
- have acquired similar previous experience and understanding of ICT usage

TEACHER LEARNING MODEL



WORKSHOPS

WORKSHOPS

EXAMPLE OF TEACHERS DEVELOPED ACTIVITY PLAN

Redzes uzlabotājs

Mācies modelējot!

Subject: **physics**
12. grade
Lesson duration: **40 min**

Students create an optical system from two lenses to achieve a maximum enlarged view.
Students understand that, by mutually combining a variety of lenses, they can achieve a enlarged view of a object.

Situtation

To see distant objects, you can mutually combine a variety of lenses obtaining objective and ocular.
How to create a "sight improver" by using given lenses to achieve a maximum enlarged view?

Activities

- Students check sight to make sure later of the effectiveness of the created device.
- Discussion about optical devices. Students create a "theoretical model" - choose lense parameteres, create drawings, showcasing the course of the beam, make calculations.
- Realistic model - "sight improver" creation, using given equipment.
- Sight test, by using the developed device. Comparing results with initial measurements, as well as with calculations and experiment obtained data.

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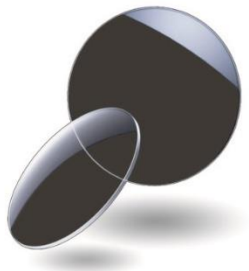
Redzes uzlabotājs

Mācies modelējot!

- Students get acquinted and test other group's "sight improvers", calculate obtained enlargement, evaluate the device's advantages and disadvantages, describe the best device's design.
- Discussions about the modelling process and its meaning.



Attēls no:
http://www.eyeglass-lenses.com/eyeglass-lenses-500.jpg

Nodarbībā izmantotas Daugavpils 3. vidusskolas skolotājas Larisas Koraševskas idejas.

Detalizētāku šo un citus piemērus meklē vietnē
http://ej.uz/stundu_piemeri

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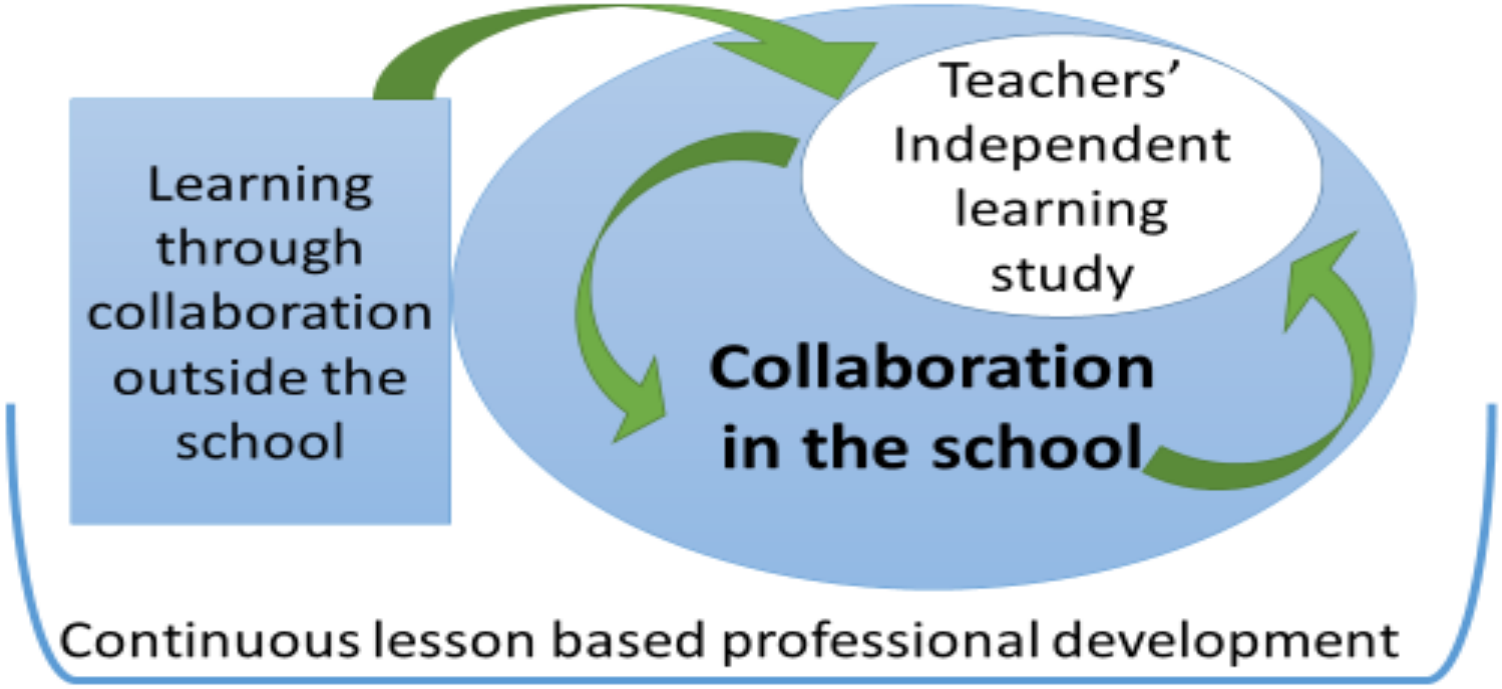
Proposed model



LESSON STUDIES

- After workshops teachers receive an individual assignment
- Learning study = independent teacher's work happening between workshops
- Development and piloting of lesson plans with the help of expert-coach
- Reflection and finding artefacts after piloting
- In other words = examination of personal practice with an aim of improving it (action research)

RESEARCH QUESTION 2

What should the next stage CPD model of building student digital competence be like?

Data collection and analysis:

- analyses of field notes
- written feedback from teachers after workshops
- focus group discussions with aim to obtain information about workshop`s impact on the teachers` teaching, reflection and collaboration skills
- analyses of teacher`s developed lesson plans by using of ICT for Learning Rubric
- teachers and experts reflections

RESULTS AFTER LESSON ANALYSIS

Level	Criteria	Lessons, %
1	Students do not have the opportunity to use ICT for this learning activity	35
2	Students use ICT to learn or practice basic skills or reproduce information. They are not constructing knowledge.	26
3	Students use ICT to support knowledge construction BUT they could construct the same knowledge without using ICT.	13
4	Students use ICT to support knowledge construction. AND the ICT is required for construction this knowledge. BUT students do not create an ICT product for authentic users.	9
5	Students use ICT to support knowledge construction. AND the ICT is required for construction this knowledge. AND students do create an ICT product for authentic users.	17

DISSEMINATION MATERIALS FOR TEACHERS

SKOLOTĀJU PROFESIONĀLĀ PILNVEIDE DIGITĀLĀS KOMPETENCES ATTĪSTĪŠANAI

Skolotāju profesionālās pilnveides posmi digitālās kompetences attīstīšanai:

PAMATPRASMJU APGUVE

- tehniskas IKT rīku lietošanas prasmes
- piemērotu digitālo resursu apzināšana
- mācību satura vizualizēšana un informācijas sniegšana

ATBALSTA SISTĒMA

- atbalsta materiālu lietošana
- labās prakses piemēri
- uzdevumi skolēniem ar pieejamiem digitālajiem resursiem
- mācību procesa organizēšana atbilstoši plānotajiem mērķiem

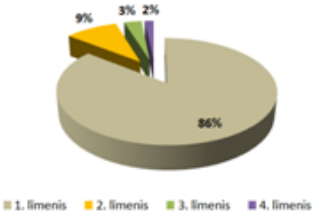
DZIĻĀ MĀCĪŠANĀS

- tehniskas IKT rīku lietošanas prasmes personalizētam mācību procesam
- tehniskas IKT rīku lietošanas prasmes profesionālajai pilnveidei
- mācību procesa plānošana mērķtiecīgai IKT rīku lietošanai, kas fokusēta uz skolēnu dažādu kompetenču attīstību un pilnveidi

KO SAKA PĒTĪJUMI?

PAR ESOŠO SITUĀCIJU LATVIJĀ:

Skolotāji Latvijā ir apguvuši pamatprasmes IKT rīku un digitālo resursu lietošanā. Skolotājiem ir zināšanas par jēgpilnu IKT rīku lietošanu mācību procesā, bet izpildījums praksē ne vienmēr par to liecina. Ir jāveido jauni profesionālās pilnveides nodarbību formāti. LU DZM IC pētījumā (2014 - 2016) tika vērotas 64 dabaszinātņu stundas dažādās Latvijas skolās: 78% no stundām tiek lietoti IKT rīki un digitālie resursi, bet tikai 22% no stundām, kurās tiek lietoti IKT rīki, tos lieto skolēni. Kādam mērķim skolēni lieto IKT šajās stundās, tika analizēts, izmantojot rubriku IKT lietojums mācību procesā (Microsoft Partners in Learning).



Līmenis	Kritēriji
1	Skolēniem **nav iespējas** izmantot IKT aktivitātes veikšanai
2	Skolēni lieto IKT, lai apgūtu vai pilnveidotu **pamatprasmes** vai **reproducētu** informāciju. Skolēni nekonstruē zināšanas
3	Skolēni lieto IKT zināšanu konstruēšanai, bet šīs pašas zināšanas **var konstruēt arī bez IKT rīkiem**
4	Skolēni lieto IKT **zināšanu konstruēšanai** un IKT ir **nepieciešams**, lai konstruētu šīs zināšanas, bet skolēni nerada produktu
5	Skolēni lieto IKT **zināšanu konstruēšanai** un IKT ir **nepieciešams**, lai konstruētu šīs zināšanas, un skolēni **rada** IKT produktu

CITUR PASAULĒ:

Lai skolotāju profesionālajai pilnveidei būtu paliekošs efekts, tā ir jāveido, balstoties uz skolotāju vajadzībām, organizējot mācīšanās grupas, sadarbojoties ar kolēģiem. Skolotājam ir jābūt savas mācīšanās centrā, lai viņš varētu mainīt savus IKT rīku lietošanas paradumus.

Skolotāju profesionālās pilnveides **faktori**, kas ietekmē IKT lietošanas praksi mācību procesā:

- ja grupā ir līderis, kas aizrauj un demonstrē iniciatīvu;
- ir pietiekami laiks tehnisko prasmju apguvei;
- ir pietiekami laiks IKT mērķtiecīga lietojuma plānošanai;
- neformāla mācīšanās ir kā vērtība;
- ir kopienas atbalsts - kolēģi, kas līdzdarbojas;
- ir uzreiz redzama jaunās pieejas ietekme.

Skolotāju profesionālās pilnveides **forma**, kas ietekmē IKT lietošanas praksi mācību procesā:

- mācīšanās nelielās grupās ar kolēģiem ar atšķirīgu pieredzi;
- stundu vērošana un analīze;
- darbs ar skolēniem - modelēšana.

IZMANTOTĀ LITERATŪRA:

Daly, C., Pachler, N., & Pelliccione, C. (2009); Dudarova I, Nemanova D. (2016); Ferrari A. (2012). UNESCO. (2011).

NEXT STAGE

	III stage
ICT tools and resources	To acquire the technical skills to use ICT tools for personalized learning (tablets, mobile phones, digital platforms etc.) To identify and acquire new generation ICT education tools and resources for CPD, for example: - Learning Designer (http://learningdesigner.org) - InstaGrők (https://www.instagrok.com) - Graasp (http://graasp.eu/) etc.
	Preliminary: Deeper learning model
The aim of teaching/ learning	To design a teacher own lessons with purposeful use of ICT tools and resources in teaching/learning process: - to encourage students to think in new ways, to persist in the face of challenges - to help students actively construct knowledge, to solve complex problems - to encourage students to communicate effectively, to work well in teams - to develop student`s skills to monitor and direct their own learning

Discussion and conclusions

The model corresponds to recommendations found in sources of literature:

1) CPD needs to be designed on the basis of meeting teacher individual needs as a priority
2) Collaborative approaches should be core to designing ICT CPD (Daly, Pachler, Pelletier, 2009)

Teachers need to be at the centre of their own learning if they are to change their deep-seated beliefs and habits regarding use of technology.

Further research

- There is room for improvement: a need for more experience in learning how to implement teaching of 21st skills
- Dissemination of good practices
- The testing of proposed model in practice
- More in-depth research on impact of the transversal competences on overall student outcome

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