Univerza v Ljubljani
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Lessons from COVID-19 Times – Should Prospective Teachers Develop Their Own Online Classrooms Already During Their Tertiary Education?

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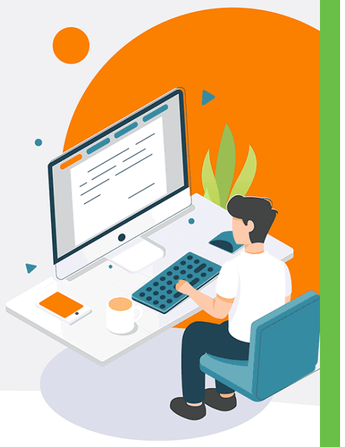
Introduction

moodle
Empowering educators to improve our world

The impact of Covid-19 on online learning

The Moodle numbers



Schools, universities & educational institutions are making the jump to creating online learning environments

Around **50,000 new Moodle sites** have been registered since **March 2020**.

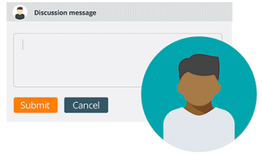
Instructors and administrators are gearing up to deal with moving to elearning

18,104 participants have been trained in Moodle Admin Basics, of which **14,174 first accessed** it when lockdowns starting taking place.

The need for mobile learning has increased as more students learn from home

There were **4,504,000 active devices** on the Moodle App in the last month, vs **1,305,000** this time last year.

Our community is more active than ever



15 million more new activities are being created on registered Moodle sites in the last month, compared to the previous month.

Moodlers are reaching out to each other and collaborating in our Community Forums, with an **average of 2,200 new posts per week** in March and April.

The demand for online learning environments is on the rise

Moodle Cloud has 1.67 million new learners now vs **453,000** last year.

See more stats at
stats.moodle.org

moodle

Source: Moodle in numbers during Covid-19 (2020) by Kinga Pilarek

Background

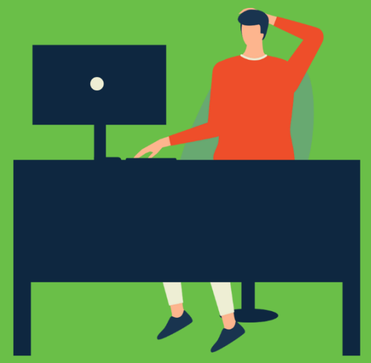
Study Programme:
first cycle university study programme at University of Ljubljana, Faculty of Education, the two-subject teacher (Chemistry)

Name of the Subject:
Information Tools in Chemistry Instruction

Number of enrolled students in academic year 2020/21: 29

Information Tools in Chemistry Instruction course content

1. Digital competencies important for chemistry teachers - DigCompEdu framework.
2. Challenges and opportunities of using ICT in chemistry teaching.
3. Scientific information literacy.
4. Visualization in chemistry and chemistry education.
5. Programs for drawing 2D chemical structures and reaction schemes.
6. Programs for 3D drawing chemical structures and simple programs for molecular modelling.
7. The programs for development of 2D and 3D animations in chemistry.
8. The programs for development of conceptual maps in the field of chemistry.
9. The programs for development of interactive tasks/tests in chemistry.
10. The programs for the processing of videos of experiments and their integration in active teaching chemistry.
11. Programmes for development of interactive e-learning units for teaching chemistry.
12. Programmes for development of interactive resources to be used with e - board for teaching chemistry.



Students, prospective chemistry teachers integrated their knowledge and skills acquired in the course to create online classrooms to support teaching and learning of a selected context-based chemistry topic.

Key Objectives

→ Update the implementation of the course based on the DigCompEdu framework (European Framework for the Digital Competence of Educators).

→ Give students, prospective chemistry teachers opportunity to integrate acquired knowledge to create individual online classroom.

→ Development of prospective chemistry teachers TPACK (Technological, pedagogical content knowledge).

→ Shed light on whether the results of TPACK performance-assessment and self-assessment survey relate with each other.

→ Encourage 1st year students to reflect on themselves as prospective chemistry teachers.

Theoretical background

Technological, pedagogical content knowledge - TPACK

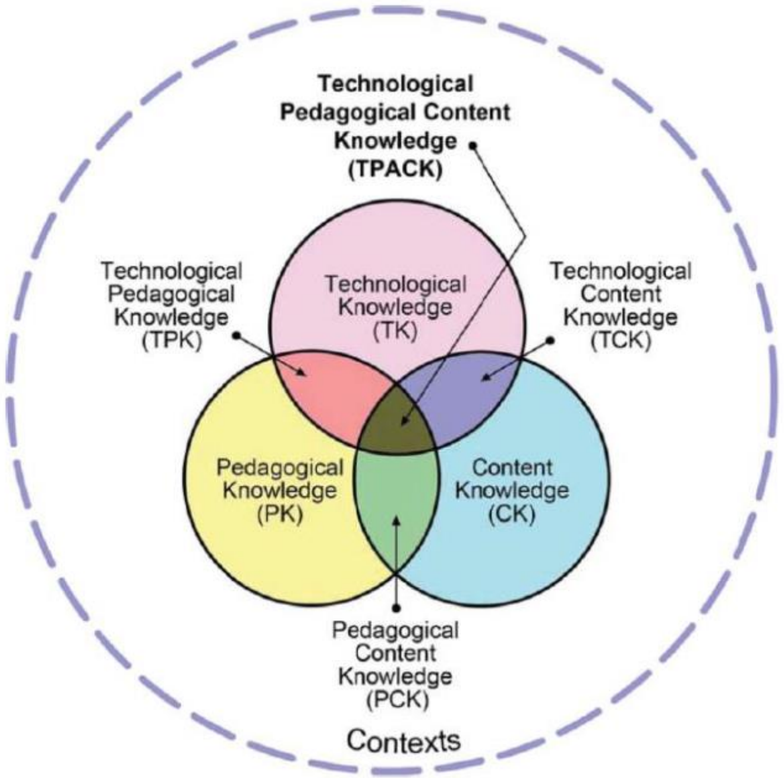


Figure: The seven components of TPACK (Koehler, 2016)

Koehler, M. (2016). *The TPACK Image.* http://www.matt-koehler.com/tpack/using-thetpack-image; Reproduced by permission of the publisher,© 2012 by tpack.org

Theoretical background

European Framework for the Digital Competence of Educators – DigCompEdu

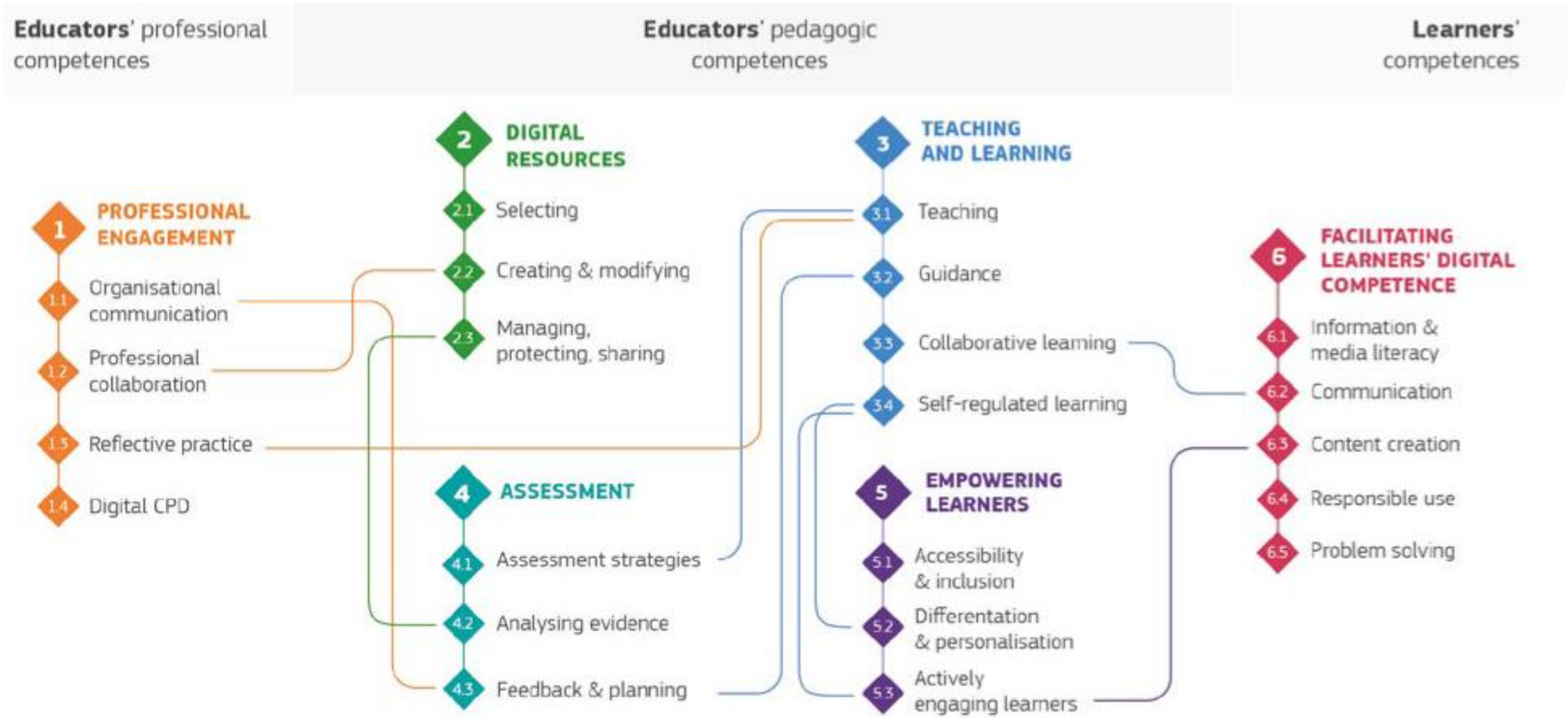


Figure: The DigCompEdu framework (Punie, 2017)

Punie, Y. (ed.). (2017). European Framework for the Digital Competence of Educators: DigCompEdu. Luxembourg: Publications Office of the European Union. EUR 28775. https://ec.europa.eu/jrc/en/digcompedu

Overview of research methods

Participants, data collection

The sample represented the whole generation of students, prospective chemistry teachers enrolled in the 1st year of the study program The two-Subject Teacher (Chemistry) at the University of Ljubljana, Faculty of Education (N = 29).

- Measuring technological pedagogical content knowledge (TPACK) through performance assessment (Akyuz, 2018).

- Measuring technological pedagogical content knowledge (TPACK) through self-assessment survey (Schmidt et al., 2009).

- Qualitative research methods - analyzing students reflections on what they found most important from their perspective as prospective chemistry teachers.

Adaptation of the implementation of the teaching process at the time of COVID-19

ACADEMIC YEAR 2018/2019

Implementation of lectures and tutorials in computer classroom

Lectures and tutorials at the faculty (online classroom Moodle for students).

Presentation of instructions for seminar work and criteria.

Students prepare seminar presentation with support and guidance

Evaluating seminar work, presentations and exam - tutorials.

Students consolidate knowledge and skills using examples from tutorials.

Students present their seminar work at the final conference of the course.

Written exam.

ACADEMIC YEAR 2019/2020

Online implementation of lectures and tutorials

Lectures and tutorials (online classroom Moodle for students and distance student contact).

Presentation of instructions for creating an individual online classroom and criteria.

Students create online classrooms with support and guidance.

Evaluating online classrooms and presentations.

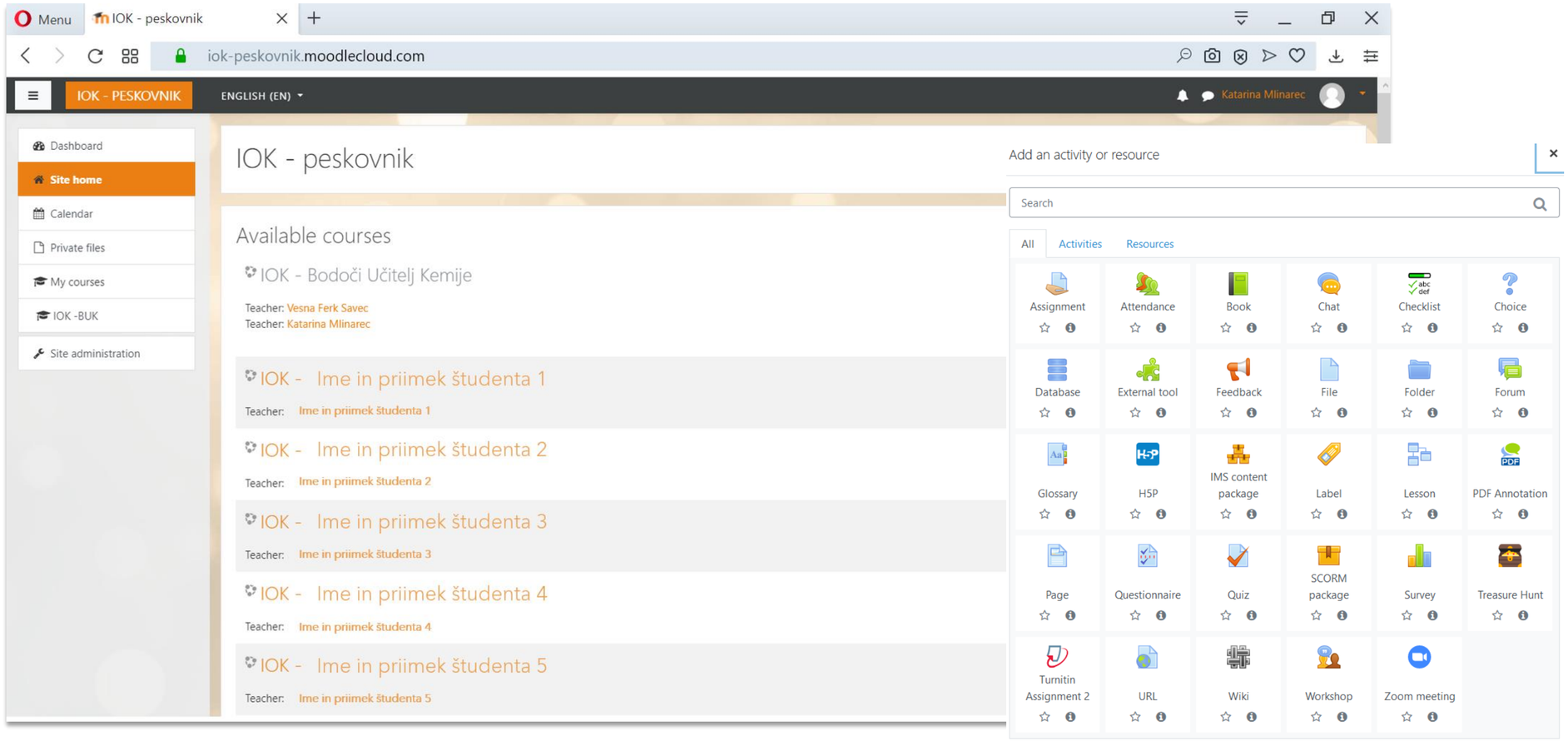
Evaluation of the course implementation

Students participate in the role of students in five online classrooms of their colleagues -> SWOT analysis of findings.

Students present developed online classrooms at the final conference of the course.

Online oral exam.

Online classrooms - Moodle Sandbox



Instructions with descriptions of student activities for creating an individual online classroom in Moodle

3. Kriteriji ocenjevanja

3.1 Naslov enote

- Izberite temo, problem v povezavi s kemijo v vsakdanjem življenju (npr. kemijo v kuhinji, kemijo na vrtu, kemijo v kopalnici).
  0 T - Izbrana tema ni povezana s kemijo v vsakdanjem življenju.
  1 T – Ustrezno izbrana tema v povezavi s kemijo v vsakdanjem življenju.

3.2 Kratek uvod v izbrano temo, problem

- Zapišite kratek zapis o izbrani temi, problemu.
  0 T - Uvod ne vsebuje opredelitve zanimive situacije v povezavi z izkušnjami učencev.
  1 T – Uvod vsebuje opredelitev zanimive situacije v povezavi z izkušnjami učencev iz življenja, snovi, katerih lastnosti bodo v eksperimentu vključevane niso opredeljene.
  2 T – Uvod vsebuje opredelitev zanimive situacije v povezavi z izkušnjami učencev iz življenja, opredeljene so snovi, katerih lastnosti bodo v eksperimentu vključevane.

3.3 Videoposnetek izvedbe eksperimenta vezanega na izbrano temo, problem

- Načrtujte in posnemite izvedbo preprostega eksperimenta na izbrano temo, problem v povezavi s kemijo v vsakdanjem življenju. Pri načrtovanju eksperimenta in snemanju ne pozabite upoštevati kemijske varnosti, izbrati ustrezne spremenljivke in konstante, ipd.).
  0 T – Izbran eksperiment ni smiselno povezan z uvodom.
  1 T – Izbran eksperiment je smiselno povezan z uvodom, pri čemer so konstante in spremenljivke, vendar so pri navajanju manjše nedoslednosti, spremembe pri kemijski reakciji so vidne.
  2 T – Izbran eksperiment je smiselno povezan z uvodom, pri čemer so konstante in spremenljivke jasno opredeljene, spremembe pri kemijski reakciji so dobro vidne.
- Videoposnetek obdelajte v orodju za obdelavo videoposnetkov MovieMaker. Obvezno naj vsebuje naslovnico, smiselno zapisano besedilo k posameznim delom, videoposnetek naj bo brez zvoka in smiselno dolg (prikaz bistvenega).
  0 T – Videoposnetek ne vključuje naslovnice z naslovom, zapise k posameznim delom.
  1 T – Videoposnetek vključuje naslovnico z naslovom, vstavljene zapise k posameznim delom z manjšimi napakami, pomanjkljivostmi, ni smiselno dolg (neustrezna hitrost za branje, opazovanje), zvok ni izključen.
  2 T – Videoposnetek vključuje naslovnico z naslovom, vstavljene zapise k posameznim delom brez napak, pomanjkljivosti, je smiselno dolg in brez zvoka.
- Videoposnetek shranite v visoki ločljivosti in ga naložite na svoj YouTube kanal. Povezavo do videoposnetka delite na spletni učilnici.
  0 T – Videoposnetek ni shranjen v obliki .mp4.
  1 T – Shranjen videoposnetek (.mp4), brez povezave v spletni učilnici do videoposnetka na YouTube-u.
  2 T – Shranjen videoposnetek (.mp4) in povezava v spletni učilnici do videoposnetka na YouTube-u.

3.4 PowerPoint predstavitev, vezana na izbrano temo, problem z vključenimi gradniki

PowerPoint predstavitev na izbrano temo, problem v povezavi z eksperimentom naj smiselno vključuje:

- zanimivo izhodišče ob uporabi virov, ki jih pridobite na spletnih straneh in portalih, bazah podatkov, pri čemer ustrezno citirajte vse uporabljene vire in vizualizacijske elemente;
  0 T - Izhodišče ne vsebuje opredelitve zanimive situacije v povezavi z izkušnjami učencev iz življenja.
  1 T – Izhodišče vsebuje opredelitev zanimive situacije v povezavi z izkušnjami učencev iz življenja, ob uporabi manj kot treh virov, pridobljenih na spletnih straneh in portalih, bazah podatkov.
  2 T – Izhodišče vsebuje opredelitev zanimive situacije v povezavi z izkušnjami učencev iz življenja, ob uporabi vsaj treh virov, pridobljenih na spletnih straneh in portalih, bazah podatkov.
- fotografije (lastno avtorstvo oziroma uporaba fotografij in ustrezno navajanje vira);
  0 T – Predstavitev ne vključuje fotografij.
  1 T - V predstavitev je vključena vsaj ena fotografija, a avtorstvo ni navedeno.
  2 T – V predstavitev je vključena vsaj ena fotografija, ki je avtorska oziroma je vir fotografije naveden.
- vgrajen videoposnetek (točka 1.3, lahko kot povezava na videoposnetek);
  0 T – V predstavitev ni vključenega videoposnetka (točka 1.3) ali povezave nanj.
  1 T – V predstavitev je vključen videoposnetek (točka 1.3) ali povezava nanj.
- slike strukturnih/racionalnih formul (izdelane v ChemSketch; v povezavi z eksperimentom);
  0 T – V predstavitev ni vključene niti ene slike strukturne/racionalne formule snovi, katere lastnosti so v eksperimentu vključevane.
  1 T – V predstavitev je vključena vsaj ena slika strukturne/racionalne formule snovi, katere lastnosti so v eksperimentu vključevane. Strukturne/racionalne formule prikazane/zapisane z manjšimi napakami (npr. neenaka dolžina vezi med atomi v strukturni formuli, …).
  2 T – V predstavitev je vključena vsaj ena slika strukturne/racionalne formule snovi, katere lastnosti so v eksperimentu vključevane. Strukturne/racionalne formule so pravilno prikazane/zapisane (npr. enaka dolžina vezi med atomi v strukturni formuli, podpisana števila v racionalnih formulah…).
- slike modelov molekul (vsaj dva različna modela, npr. kroglični in kalotni; belo ozadje; vidne naj bodo dvojne/trojne vezi, če so le te prisotne v molekuli);
  0 T – V predstavitev ni vključene niti ene slike modela molekule snovi, katere lastnosti so v eksperimentu vključevane.
  1 T – V predstavitev je vključena vsaj ena slika modela molekule snovi, katere lastnosti so v eksperimentu vključevane. Prikazana je ena vrsta modela molekule, na belem ozadju. Dvojne/trojne vezi v modelu molekule niso prikazane.
  2 T – V predstavitev je vključena vsaj ena slika modela molekule snovi, katere lastnosti so v eksperimentu vključevane. Prikazana sta vsaj dva različna modela molekule, na belem ozadju. Če so v molekuli dvojne/trojne vezi so te v modelu prikazane.
- vključitev spletnega vira (kot prikaz spletne strani; smiselno glede na izbrano temo, problem);

Instructions with descriptions of student activities for creating an individual online classroom in Moodle

In the development of online classroom students needed to include the following components:

1 Choice of topic/problem related to chemistry in everyday life (e.g. chemistry in the kitchen, chemistry in the garden, chemistry in the bathroom).

2 Brief introduction to the chosen topic/problem.

3 Video of the experiment in relation to the chosen topic/problem. Consideration of chemical safety, selection of appropriate variables and constants, editing of the video in MovieMaker, sharing the video on the YouTube channel. The link to the video should be available in the online classroom.

Instructions with descriptions of student activities for creating an individual online classroom in Moodle

In the development of online classroom students needed to include the following components:

4 PowerPoint presentation on chosen topic/problem with included:

- Interesting introduction using sources from websites and portals, chemistry databases (correctly citing the sources and visualization elements used);
- Photos (own authorship or use of photos and proper citation of source);
- Embedded videos;
- Images of structural/rational formulae (e.g., created in ChemSketch);
- Images of molecular models (at least two different models);
- Embedding of a web source (as a representation of a web page; useful depending on the chosen topic, problem);
- One or more interactive tasks (e.g., tasks created in LearningApps.org).
- Synthesize essential chemical focus using representations of chemical concepts and processes at all three levels.

Instructions with descriptions of student activities for creating an individual online classroom in Moodle

In the development of online classroom students needed to include the following components:

5 Other didactic materials related to the chosen topic/problem.
Creation and meaningful integration into the online classroom (as an activity for students, additional instructions...):

- 5.1 Interactive assignments.
- 5.2 Chemical databases.
- 5.3 Formative assessment.
- 5.4 Animations.
- 5.5 Concept maps or mind maps.

6 Literature and other sources used are cited according to APA Style 7th Edition.

Placement of student activities within the framework of DigCompEdu

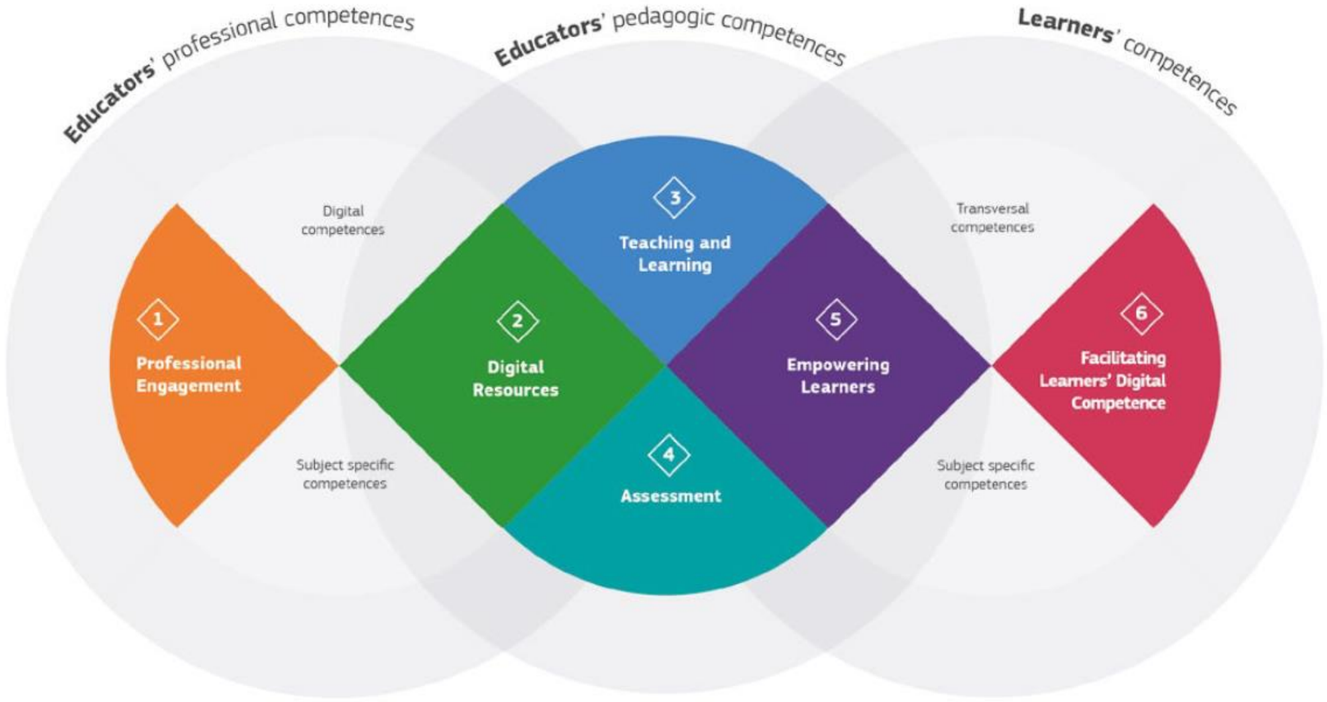


Figure: DigCompEdu areas and scope (Punie, 2017)

01 Professional Engagement

02 Digital Resources

1 2 3 4 5 6

03 Teaching and Learning

1 2 3 4 5

04 Assessment

4 5

05 Empowering Learners

5

06 Facilitating Learners' Digital Competence

1 3 4 5 6

Punie, Y. (ed.). (2017). European Framework for the Digital Competence of Educators: DigCompEdu. Luxembourg: Publications Office of the European Union. EUR 28775. https://ec.europa.eu/jrc/en/digcompedu

Results

Examples/snapshots from students‘ individual online classrooms in Moodle.

CREATING INDIVIDUAL ONLINE CLASSROOMS

EXAMPLE 1:
Bioethanol from household waste

EXAMPLE 2:
Natural indicators

EXAMPLE 3:
How to remove limescale?

EXAMPLE 4:
What happens when you put an effervescent tablet in water?

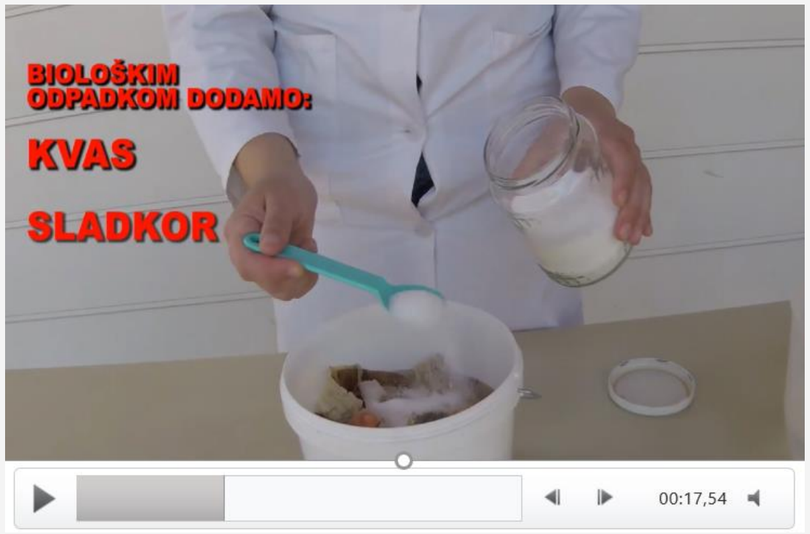
EXAMPLE 5:
Coca-Cola and Mentos candies - does the chemical reaction really take place?

EXAMPLE 6:
What is the chemical composition of vinegar and how to make it?

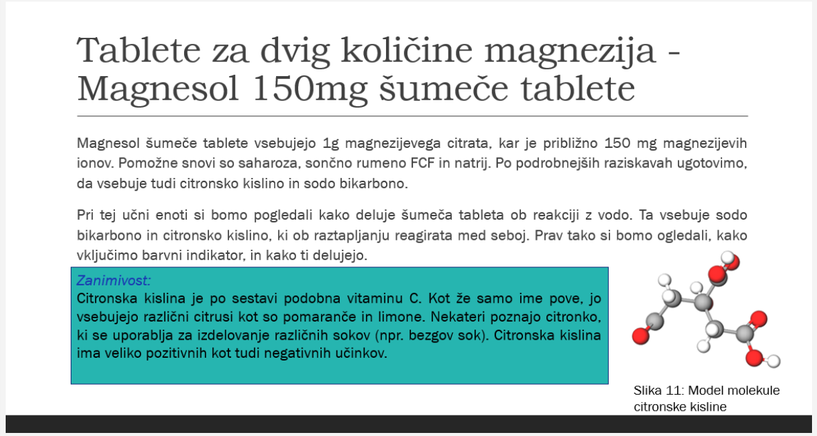
Results

Examples/snapshots from students' individual online classrooms in Moodle.

CREATING INDIVIDUAL ONLINE CLASSROOMS AND DEVELOPING RELATED ACTIVITIES…



Sedaj, ko že veliko veš o vodnem kamnu se preizkusi v igri milijonar.



Tablete za dvig količine magnezija - Magnesol 150mg šumeče tablete

Magnesol šumeče tablete vsebujejo 1g magnezijevega citrata, kar je približno 150 mg magnezijevih ionov. Pomožne snovi so saharoza, sončno rumeno FCF in natrij. Po podrobnejših raziskavah ugotovimo, da vsebuje tudi citronsko kislino in sodo bikarbono.

Pri tej učni enoti si bomo pogledali kako deluje šumeča tableta ob reakciji z vodo. Ta vsebuje sodo bikarbono in citronsko kislino, ki ob raztapljanju reagirata med seboj. Prav tako si bomo ogledali, kako vključimo barvni indikator, in kako ti delujejo.

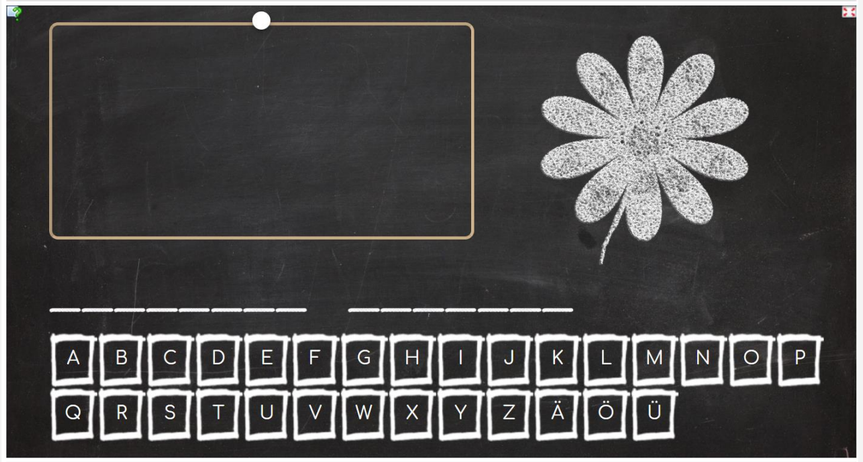
Zanimivost:
Citronska kislina je po sestavi podobna vitaminu C. Kot že samo ime pove, jo vsebujejo različni citrusi kot so pomaranče in limone. Nekateri poznajo citronko, ki se uporablja za izdelovanje različnih sokov (npr. bezgov sok). Citronska kislina ima veliko pozitivnih kot tudi negativnih učinkov.

Slika 11: Model molekule citronske kisline

Results

Examples/snapshots from students‘ individual online classrooms in Moodle.

CREATING INDIVIDUAL ONLINE CLASSROOMS AND DEVELOPING RELATED ACTIVITIES…



Results

Comparison of TPACK performance-assessment vs. self-assessment

Table: Comparison of self-assessment (first column in each knowledge domain) and performance-assessment (second column in each knowledge domain) for all seven knowledge domains.
The third columns show the difference scores. Mean and the sample standard deviation are shown in the bottom two rows.

	CK			PK			TK			PCK			TCK			TPK			TPACK		
S1	3,2	3,1	0,1	4,4	2,4	2,0	3,7	3,2	0,5	3,8	3,3	0,5	3,8	4,0	-0,3	4,2	2,7	1,5	4,0	5,0	-1,0
S2	4,2	3,9	0,3	2,4	1,9	0,5	4,1	3,8	0,3	4,0	4,0	0,0	4,0	4,1	-0,1	3,8	2,1	1,7	3,9	2,2	1,7
S3	4,3	3,9	0,4	4,6	3,2	1,4	4,9	4,6	0,3	2,3	2,0	0,3	2,8	2,2	0,6	5,0	4,2	0,8	3,5	3,1	0,4
S4	4,6	4,2	0,4	4,4	2,0	2,4	5,0	4,5	0,5	3,8	3,1	0,7	4,5	4,0	0,5	4,6	2,8	1,8	4,4	2,8	1,6
S5	2,8	3,0	-0,2	3,3	3,1	0,2	3,6	3,7	-0,1	2,8	2,1	0,7	2,8	2,0	0,8	4,0	3,5	0,5	3,4	2,1	1,3
S6	3,4	3,5	-0,1	3,7	2,0	1,7	5,0	4,8	0,2	3,3	3,0	0,3	3,5	3,1	0,4	4,0	2,9	1,1	3,9	1,9	2,0
S7	3,3	3,5	-0,2	3,9	1,3	2,6	3,7	3,6	0,1	3,0	2,6	0,4	3,3	3,5	-0,3	3,0	2,0	1,0	3,3	2,4	0,9
S8	3,3	2,8	0,5	3,9	2,3	1,6	3,3	3,2	0,1	3,3	2,4	0,9	3,3	2,9	0,4	4,0	3,1	0,9	4,0	3,0	1,0
S9	2,8	1,7	1,1	3,6	3,2	0,4	3,4	4,4	-1,0	1,0	2,4	-1,4	2,8	3,6	-0,9	4,4	2,8	1,6	3,0	3,8	-0,8
S10	4,0	4,8	-0,8	3,9	2,8	1,1	4,1	4,4	-0,3	3,5	3,4	0,1	3,0	3,9	-0,9	4,0	3,7	0,3	3,5	2,0	1,5
Mean	3,60	3,44	0,16	3,80	2,42	1,38	4,09	4,02	0,07	3,05	2,83	0,22	3,35	3,33	0,02	4,10	2,98	1,12	3,68	2,83	0,85
Std.	0,63	0,86	0,52	0,63	0,64	0,84	0,66	0,59	0,44	0,89	0,64	0,63	0,59	0,76	0,58	0,53	0,68	0,52	0,42	0,97	1,02

Results

Some examples of students' opinions on the implementation of the course (source: questionnaire at the end of the course).

EXAMPLE 1

» From the perspective of a future chemistry teacher, I think it's important that we know how to diversify and improve the quality of our teaching with the help of technology. It is good that we find ourselves in the case of ICT problems and that we know how to solve them. «

EXAMPLE 2

» I think I learned many new methods and ways of teaching during my studies, more than I would have thought. I have learned many new things and also things that I will encounter or have already encountered in my everyday life. I have learned critical thinking as well as how to accept constructive criticism, which is very helpful in constantly improving as a chemistry teacher. «

EXAMPLE 3

» I think technology can be very helpful in teaching and learning chemistry, but I think we need to be careful when using it and be aware of its limitations in order to use it appropriately (e.g. availability of ICT devices in school). It is important that we are given as many opportunities to use ICT as possible so that we can find out for ourselves which solutions are useful and which are not. «

EXAMPLE 4

» Creating an online classroom seemed like a "meaningful" way to end the subject because we could really show what we learned in the subject tutorials and lectures. Creating an online classroom was a really nice and interesting experience for me. As a future chemistry teacher, it makes sense to me to prepare material in a way that appeals to students and helps them learn. And that's why I really enjoyed creating an online classroom, because I had the opportunity to create something "of my own" and learn a lot in the process. Moreover, when the online classrooms were also analyzed by colleagues, I got some feedback information that helped me to think about what I can improve in the future. «

Conclusion

SWOT analysis

STRENGTHS

- Updating the implementation of the course based on the DigCompEdu framework, which allows a more integrated development of future chemistry teachers in terms of didactic use of ICT.
- Linking and interweaving the content of course lectures and tutorials.
- Demonstrating students' acquired integrated knowledge in the creation of their own online classroom to support the teaching and learning of a selected chemistry topic in the context of everyday situations (with reference to school practice).
- Encourage 1st year students to reflect on themselves as future chemistry teachers.

WEAKNESSES

- Restrictions on setting up and using online classrooms for students.
- Additional time is needed to support students in setting up an online classroom and overcoming various challenges.

OPPORTUNITIES

- Optimizing criteria (instructions) for creating a student online classroom for use in future academic years.
- Establishment of student "Moodle sandboxes" within the faculty collaborative environment.
- The possibility of upgrading student online classrooms along the study vertical.
- The possibility of testing student online classrooms with students, e.g. as part of teaching practice.

THREATS

- Objectivity of collegial assessment of online classrooms.

Conclusion

1

The results show that the adaptation of the course encouraged students to develop in the field of didactic use of ICT in accordance with the DigCompEdu model.

2

Developing students' objectivity in assessing their current knowledge and competencies and to point out areas for improvement.

3

It would be interesting to conduct research in a few years to examine how students have developed during their studies in relation to the TPACK framework.

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