

Support for Chemistry Teachers in Professional Learning Communities (PLCs) During COVID-19 Crisis

Anat Shauly, Shirly Avargil

Faculty for Education in Science and Technology
Technion – Israel Institute of Technology
Haifa, Israel



Faculty of Education
in Science and Technology
Where Science meets Education



Background

Professional Development (PD) programs help teachers adapt to scientific updates and social changes. [1]

Recent change - shift to Emergency Remote Teaching (ERT) during COVID-19 lockdowns.

ERT characteristics - temporary, fully remote, and the shift is immediate.

Teachers need support to work in ERT mode. [2]

Research Question and Conceptual Framework

What characteristics in teachers' work are related to the PLC participation, during routine and ERT, and how are they manifested in various aspects?

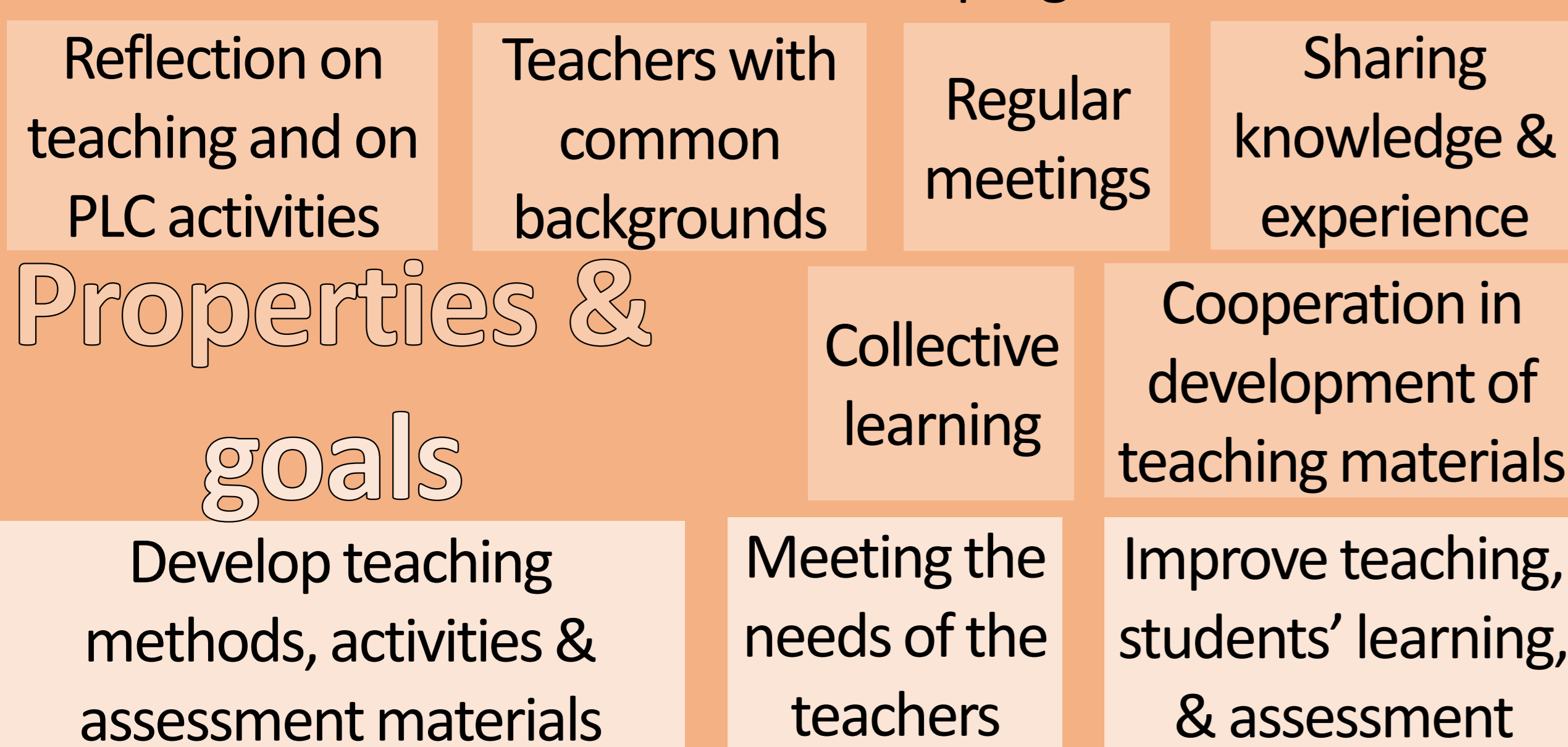
Teachers' Knowledge Refined Consensus Model (RCM):
cPCK - collective PCK
ePCK - enacted PCK [4]

Developing and supporting teachers in PLCs

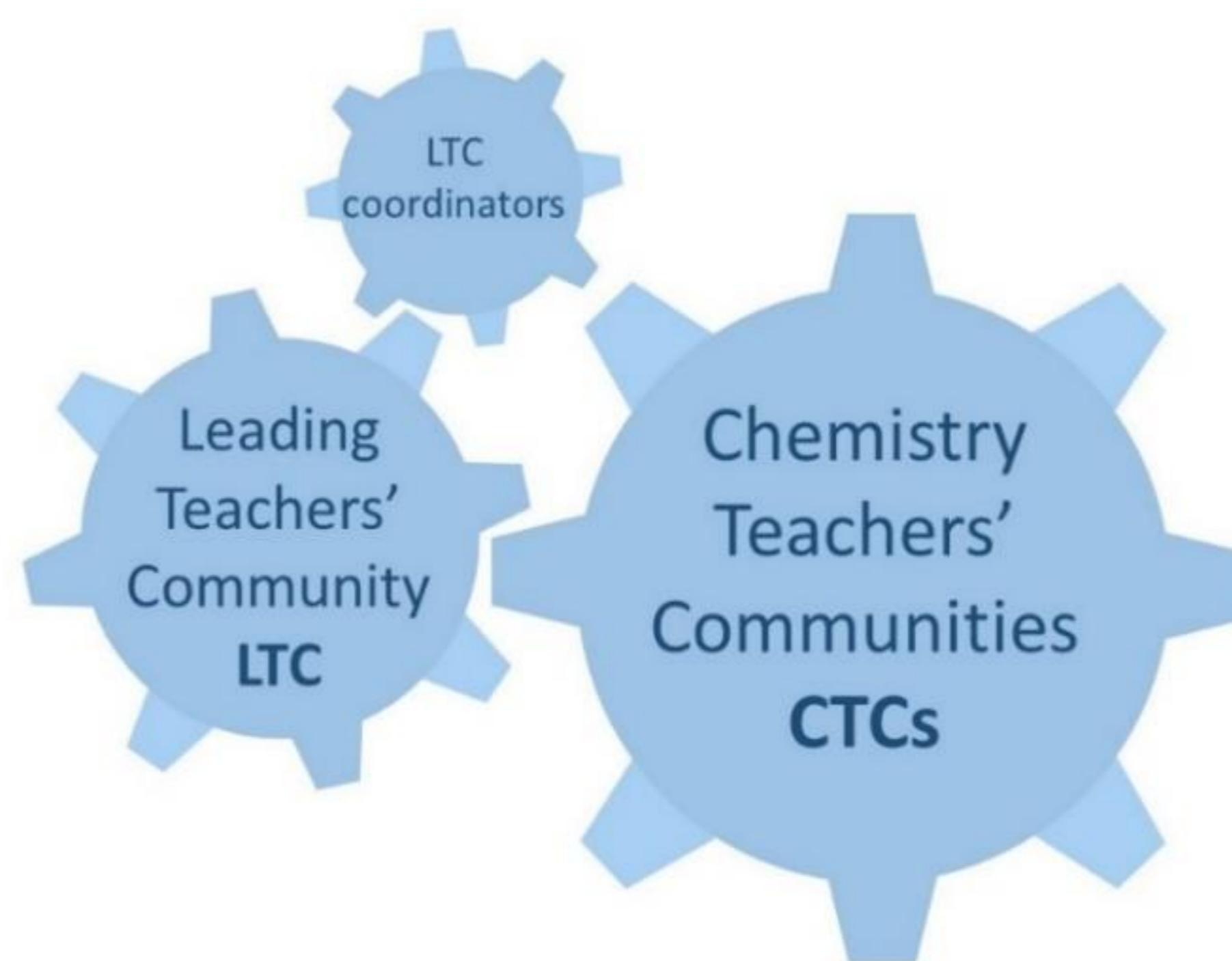
Communities of Practice (CoP) [5]

PLCs – Professional learning communities – are a rising platform for teachers' PD.

PLCs have characteristics of effective PD programs. [3]



Research Setting and Tools



PLCs network centered at the Technion

Since 2018 face-to-face or by Zoom.

- LTC– 20 experienced teachers.
- Haifa's CTC– 25 members, varied experience.

Tools:

- Observation of PLC meetings
- Moodle Correspondence

Questionnaire: Teaching in ERT mode vs. routine Respondents:

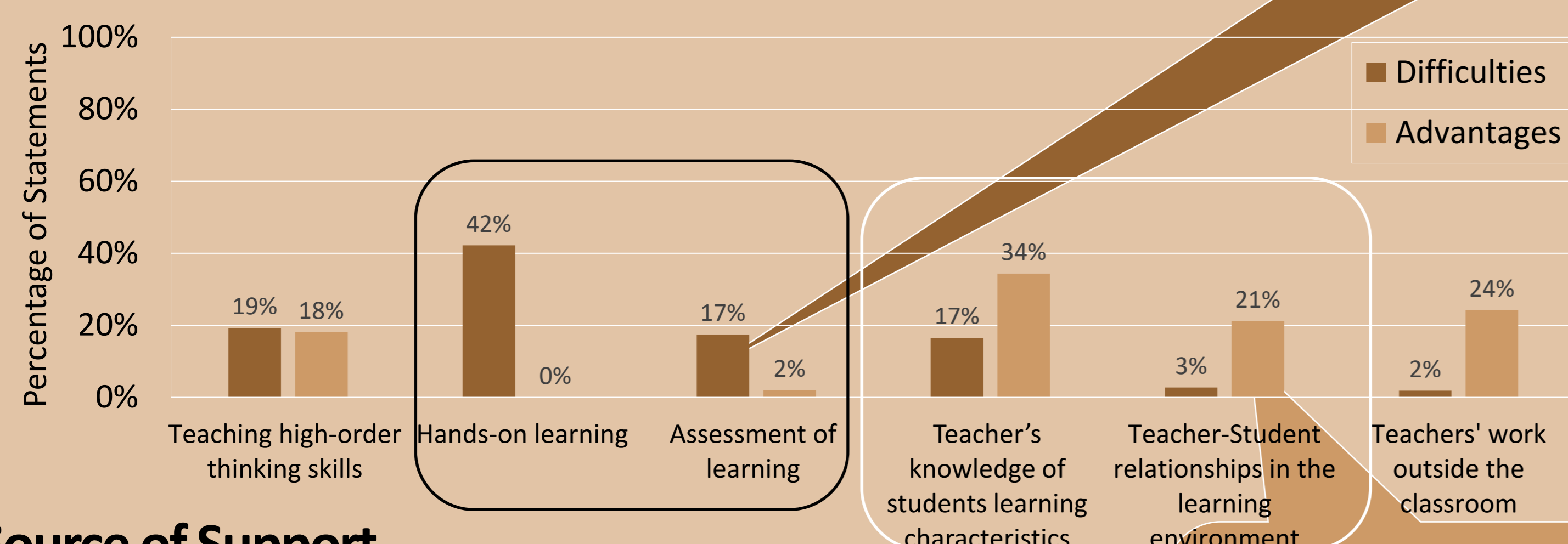
- 122 high school chemistry teachers
- PLC members 67%, Non-members 33%
- Experience: two to over 40 years
- 5 teachers Interviewed

Results - Characteristics of Teachers' Work in ERT Mode vs. Routine

Pedagogical

- What aspect of teaching was mostly disrupted in ERT?
- Are there aspects of pedagogy or education in ERT is preferable to classroom instruction?

Open ended questions: N = 208 52% - challenges 48% - advantages

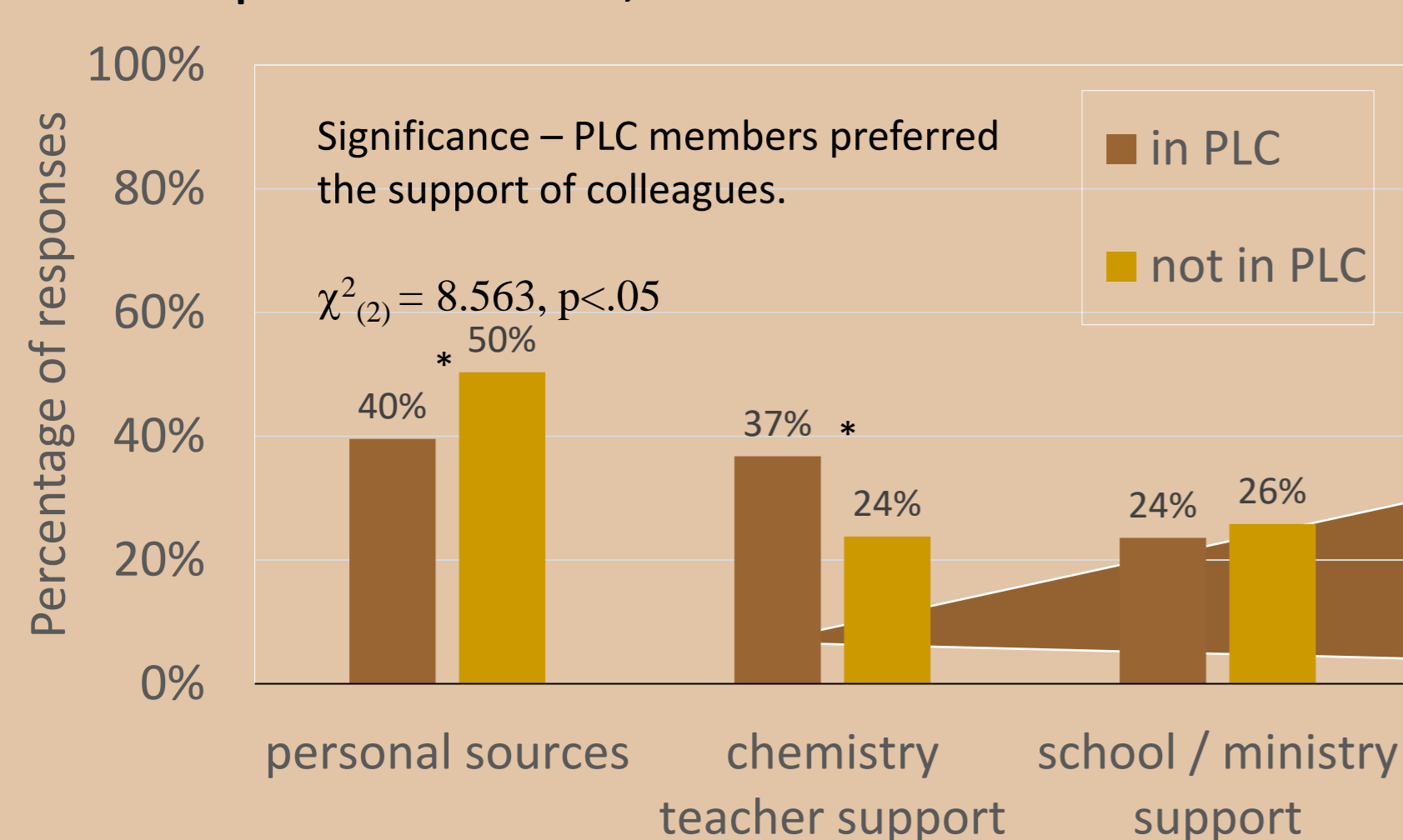


"[In Zoom] they learned and solved well; When we returned to class, I noticed they had figured out how to work with online worksheets,. But it was far from representing their true knowledge".

Source of Support

- How did you cope with the technological challenges during ERT?

Multiple answer question N=541; 73% PLC teachers



"There is a significant shift of responsibility for learning to the student.... A student can choose to be more, or less, attentive and involved in the learning process".

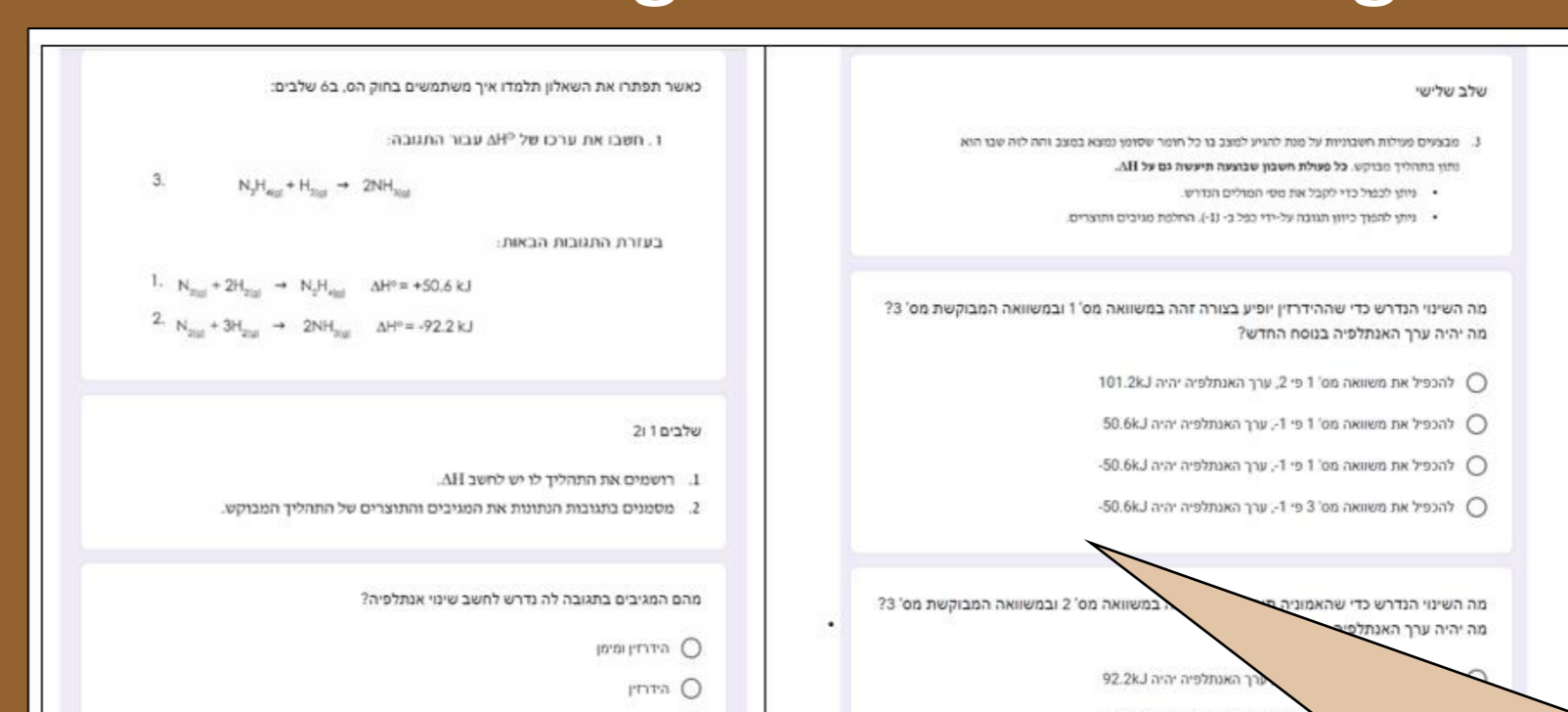
The meetings were very significant to me socially and personally during COVID [lockdowns]. Ideas for online chemistry lessons were presented... the unit "Energy in My Pace" was a masterpiece that will be very useful.

Results – Aspects of cPCK and ePCK in the PLCs

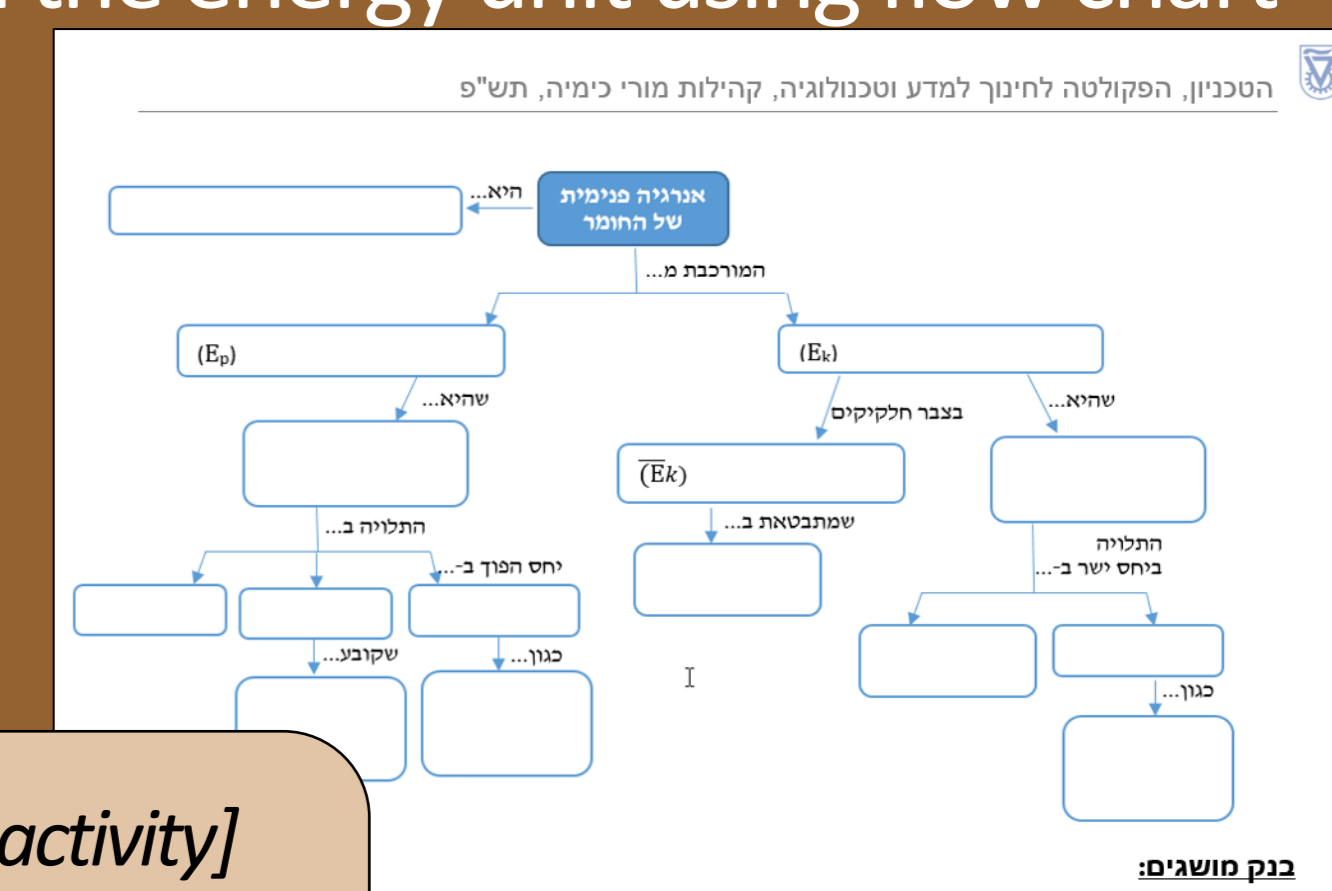
An ERT learning unit on Chemical Energy developed by LTC members -

- Firstly, teachers contributed activities.
- Secondly, coordinators combined them.

Example I: Step by step enthalpy calculation using Hess' Law in Google forms



Example II : Learning basic concepts in the energy unit using flow chart

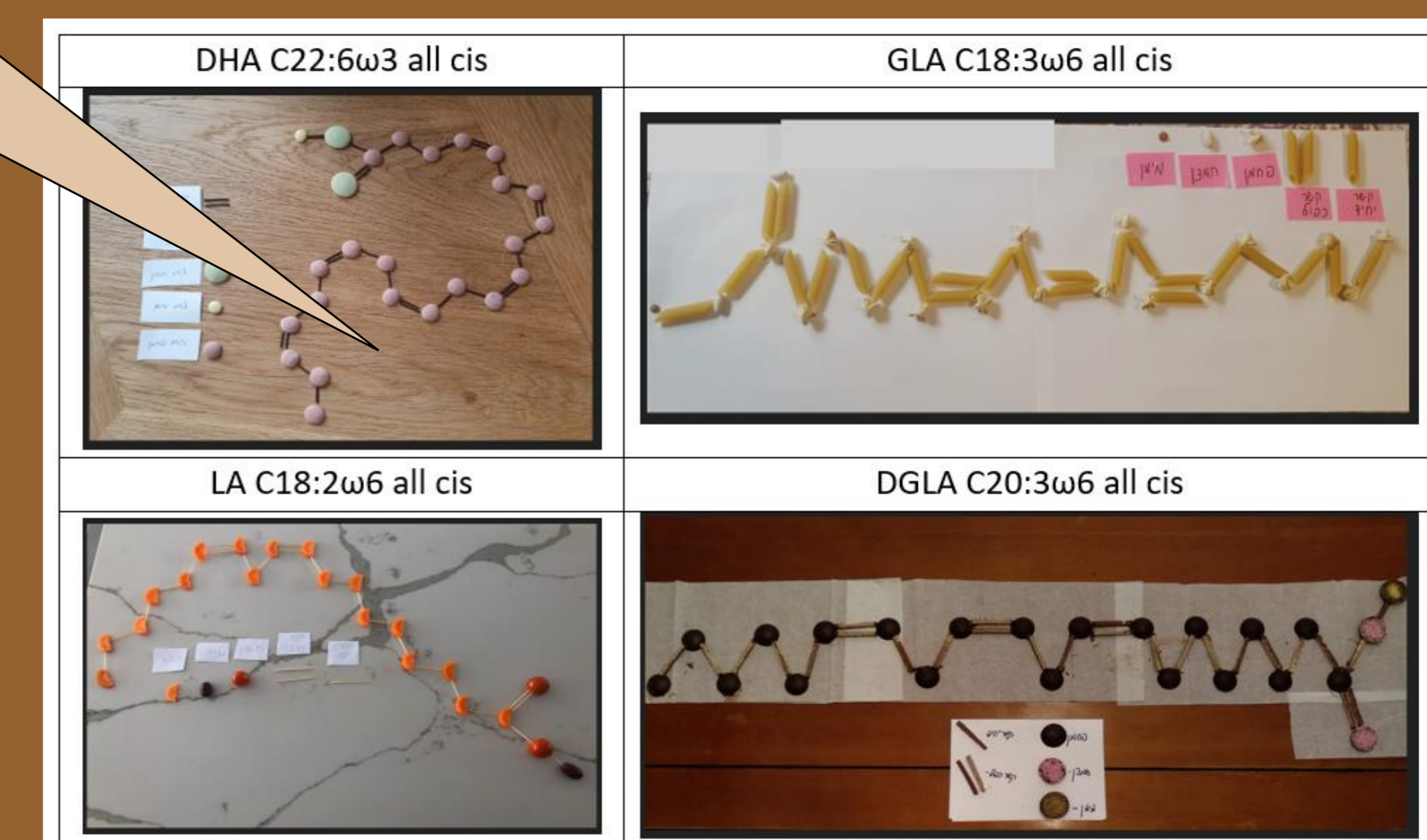


The community took us a step forward, sharing ideas and [activities] ... [teachers] became professional and shared a variety of things they created. Then they communicated it, it was excellent".

[The development activity] allows a teacher to view his students, their difficulties, and their misconceptions differently.

Adopting activities to Class

- Students were asked to model essential fatty acids at home.
- A CTC member adopted activity from PLC.
- She shared the outcomes with the community.



Conclusions and Research Contribution

Contribution of PLC membership to teachers' knowledge: Challenges of working in ERT mode:

- PLC members developed teaching activities and shared activities adapted for remote teaching within the PLCs, enhancing the community's cPCK.
- Exposure to a variety of novel tools and activities is a direct contribution to ePCK according to the RCM.

- Assessment of students' learning and knowledge, and hands-on learning were the main concern of teachers.
- Benefits of ERT: Strengthening student's Self Regulated Learning (SRL) abilities by taking charge of the learning process.
- Teachers reflected on importance of PLC membership and support during this time of extraordinary circumstances.

Unity and Support

"...I think that sharing with teachers within the community, felt better because we are all the same, all share the same challenges, and this is OK".

References

- Gess-Newsome, J., Taylor, J. A., Carlson, J., Gardner, A. L., Wilson, C. D., & Stuhlsatz, M. A. M. (2019). Teacher pedagogical content knowledge, practice, and student achievement. *International Journal of Science Education*, 41(7), 944–963.
- Hodges, C. B., Moore, S. L., Locke, B. B., Bond, A. M., & Jewett, A. (2021). An instructional design process for emergency remote teaching. In D. Burgos, A. Tili, & A. Tabacco (Eds.), *Radical Solutions for Education in a Crisis Context: COVID-19 as an Opportunity for Global Learning* (pp. 37–51). Springer Science and Business Media Deutschland GmbH.
- Orland-Barak, L. (2020). Discussion: Teacher Learning in Community: Premises, Promises and Challenges. In Y. Ben-David Kolikant, D. Martinovic, & M. Milner-Bolotin (Eds.), *STEM Teachers and Teaching in the Era: Professional Expectations and Advancement in the 21st Century Schools* (pp. 53–61). Springer Nature Switzerland AG.
- Carlson, J., & Daehler, K. R. (2019). The refined consensus model of pedagogical content knowledge in science education. In A. Hume, R. Cooper, & A. Borowski (Eds.), *Repositioning Pedagogical Content Knowledge in Teachers' Knowledge for Teaching Science* (pp. 77–92). Springer Nature Singapore Pte Ltd.
- Wenger, E. (2011). Communities of practice: A brief introduction. www.scholarsbank.uoregon.edu.ezlibrary.technion.ac.il/xmliui/handle/1794/11736