

Department of Teaching and General Studies



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Dr. Yael Furman Shaharabani, Ph.D.
Head of Department

RESEARCH AREAS

MERGING TEACHING FOR UNDERSTANDING AND ENGAGING LECTURES IN A PROTEIN ENGINEERING COURSE

Yael Furman-Shaharabani and **Hana Faiger**

Learning protein engineering is a challenge that requires students to understand complex processes. Although research results support active learning, indicating enhanced students' learning, higher education lecturers are accustomed to traditional lecturing, and lectures still prevail in undergraduate studies. This study combines the Engaging Lectures strategy with the Teaching for Understanding (TfU) approach. This mixed methods case study was performed in a Protein Engineering course. The findings indicate that TfU engaging lectures are a beneficial strategy for students and lecturers. This approach enabled a shift towards active learning while maintaining the core content and structure of existing lectures.

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Keywords: Instructional change, engaging lectures, teaching for understanding

FROM CONCEPTUAL FRAMEWORKS TO MENTAL MODELS FOR ASTRONOMY

David Pundak, **Ido Liberman** (Western Galilee College), and **Miri Shacham**

This research investigates how college students change their conceptual frameworks and create mental models for astronomy. The study deals with four areas of astronomical knowledge: sky observations, the earth and its orbit, the solar system, and stars.

A new research instrument—Conceptual Frameworks in Astronomy (Pundak, 2016)—is used for this study. The responses of 537 students from three colleges are classified according to four mental models: pre-scientific, geocentric, heliocentric, and stellar/scientific. The research identified three variables: physics background, mean academic grade, and academic discipline, which contribute to the adoption of the stellar/scientific model. The paper sheds light on the development of astronomical models in higher education.

Keywords: Astronomy, conceptual frameworks, mental models

FROM ENGINEERING TO MATHEMATICS TEACHING: PERCEPTIONS OF MATHEMATICS, MATHEMATICS TEACHING, AND MATHEMATICAL UNDERSTANDING

Ira Raveh and Yael Furman Shaharabani

Engineers who choose to change careers and become mathematics teachers are a special group as far as their mathematics learning in the context of engineering and their previous work experience are concerned. Regarding mathematics, they mainly engaged in applied mathematics associated with engineering, which is a highly practical field. It is well known that the perceptions of teachers are somewhat reflected in their teaching. Hence, it is important to study the perceptions and attitudes of this group of future mathematics teachers. This research explores experienced engineers' perceptions of mathematics-teaching related topics, before starting their studies in a pre-service mathematics teacher preparation program. This research explores their perceptions of mathematics as a discipline, mathematics teaching, and mathematical understanding.

Keywords: Career changers, engineers as teachers, mathematics teaching, mathematical understanding

INCORPORATING KAHOOT! IN ENGINEERING CONTENT-HEAVY COURSES

Victor Chernov, Sivan Klass, and Yael Furman-Shaharabani

Game-based learning is one of the tools to increase learning motivation. Kahoot! is a web based service that allows conducting multiple choice quizzes in which students participate using their web devices. In those quizzes, answers are ranked for correctness and speed. The quizzes are short and provide immediate feedback and rankings. This allows for conducting many of them during the learning period, thus providing continuous feedback and assessment both for the teacher and the student. The gaming factor motivates students to participate and prepare for the quizzes. This ongoing work examines different models of incorporation of Kahoot! quizzes in the teaching process of three courses: Fluid Mechanics in the Department of Bioengineering, Thermodynamics in the Department of Bioengineering, and Thermodynamics in the Department of Mechanical Engineering.

Keywords: Game based learning, Kahoot!, immediate feedback

MATHEMATICAL AND ENGINEERING UNDERSTANDING: THE PERSPECTIVE OF ENGINEERING STUDENTS

Ira Raveh, Elena Trotskovsky, and Nissim Sabag

The subject of mathematics has always existed in the very core of engineering education. Engineering students take many courses in mathematics during their qualification for an undergraduate degree in engineering. This study looks into how undergraduate engineering students at ORT Braude College perceive engineering and mathematical understanding—the similarities and differences between them.

Keywords: Understanding, mathematical thinking, engineering thinking

MATHEMATICAL UNDERSTANDING AND ENGINEERING UNDERSTANDING: THE EXPERT PERCEPTIONS

Ira Raveh and Elena Trotskovsky

The notion of understanding has always existed at the core of engineering and mathematical education. Nevertheless, the notion of understanding is neither unequivocal nor well defined. Many studies deal with mathematical understanding, while fewer studies address engineering thinking and understanding, very few deal with students' perceptions of mathematical and engineering understanding, and no studies explore the experts' view of the nature of mathematical and engineering understanding. This study continues the research of Raveh, Trotskovsky, and Sabag (2017) and deals with experts in engineering and mathematics perceptions of engineering understanding and mathematical understanding.

Keywords: Understanding, mathematical understanding, engineering thinking

PRE-SERVICE ENGINEERING AND MATHEMATICS TEACHERS' PERCEPTIONS AND DEVELOPMENT OF "TEACHING FOR UNDERSTANDING"

Yael Furman Shaharabani

Understanding is a main goal of teaching and learning, yet it is not easily achieved. The "teaching for understanding" approach presents a way to focus teachers' attention on their students' understanding when planning their instruction together with paying attention to students' performance. This research explores the development of engineering and mathematics pre-service teachers' perceptions of students' understanding, and their ability to plan understanding-based instruction.

Keywords: Professional development, teaching for understanding, pre-service teachers

ESSENTIAL SKILLS ON-LINE INTERNATIONAL COURSE

Miri Shacham, Sharon Tidhar, and Dvora Toledano-Kitai

The on-line international course “Essential Skills” was developed in the In2it project funded by Erasmus+. Fourteen higher education institutions from Israel and Europe are taking part in the project that is coordinated by ORT Braude College.

The course aims are to boost students’ employability skills and give them a competitive edge in the workplace and perhaps even in life, to enable them to work in an international and virtual atmosphere and to enhance their awareness and sensitivity to cultural differences.

The course deals with five main skills: reflective thinking, teamwork, leadership, creative thinking, and problem solving. One hundred and fifteen students across seven institutions from Israel, England, and Poland participated in this innovative course. The students studied online, in English, and worked in international and multicultural teams.

In this research, we conducted in-depth interviews with fifteen students (from ORT Braude College) and with four developers, regarding course relevance, content, format, and the experience of working in an international multicultural team.

Keywords: Essential skills, on-line course, reflective thinking, problem solving

COACHING PROGRAM FOR ACADEMIC SUCCESS: PROMOTING EQUAL OPPORTUNITIES FOR ENGINEERING STUDENTS

Miri Shacham and Margalit Ben-Yehuda

The research examines a special Personal-Academic Coaching (PAC) program for promoting students’ self-efficacy and academic success, which was developed and implemented in ORT Braude College, seeking to increase retention and equal opportunities to higher education. The research focuses on the contribution of the coaching program to students' self-efficacy, learning strategies, and academic achievements, and also on the contribution of coaching to the personal and professional development of lecturer-coaches.

Keywords: Coaching, academic success, self-efficacy

ELECTRICAL AND ELECTRONICS ENGINEERING EDUCATION

Nissim Sabag

This research investigates different aspects of engineering education such as problem-based learning and students' motivation, on-line education, mathematical vs. engineering understanding, and learning styles. The research is conducted in collaboration with the Technion–Israel Institute of Technology and other colleagues.

Keywords: Animation based learning, active learning, promote teaching

DOCTORAL LEARNING BETWEEN CULTURES: ENHANCING LIFELONG LEARNING

Yehudit Od-Cohen (Ohalo College) and Miri Shacham

With the increased mobility of international students and of postgraduate programs that facilitate and support them in their learning, a unique phenomenon is emerging, that of doctoral learning between different cultures. Many international doctoral students enter doctoral programs and supervisory arrangements in countries where teaching takes place in English. Consequently, they make a cultural shift, since they undertake their doctoral learning in another country, another language, and another culturally inflected learning context. This research elaborates on the findings that emerged from research focusing on the learning characteristics of international PhD graduates and on the process of lifelong learning (LLL) through and beyond their PhD studies. This research is grounded on the theories of lifelong learning, multicultural learning, and adult learning.

Keywords: Intercultural doctoral learning, lifelong learning, informal adult learning, professional development

THEORY PRACTICE GAP: TEACHERS-AS-LEARNERS QUESTIONS

Yael Furman-Shaharabani and Anat Yarden (Weizmann Institute of Science)

The gap between practice and theory is a well-known barrier to educational improvement. There is an ongoing need to understand teachers' thinking and find new ways to connect practice and theory meaningfully. The aim of the research is to explore the ways in which in-service teachers link practice and theory, using teachers-as-learners' questions asked in the context of two academic courses directed at mediating practice and theory. Thirty one experienced biology high school teachers participated in the research.

Keywords: Theory-practice gap, science teachers, in-service, teachers' questions

TEACHERS' KNOWLEDGE OF THE INTERCONNECTIONS BETWEEN THE STANDARD ALGORITHMS OF FOUR ARITHMETIC OPERATIONS AND THEIR UNDERLYING MATHEMATICAL PRINCIPLES

Ira Raveh, Boris Koichu (Technion–Israel Institute of Technology), Orit Zaslavsky (Technion–Israel Institute of Technology and New York University), and Irit Peled (University of Haifa)

This study aims to identify the components of schoolteachers' mathematical knowledge regarding the teaching of standard algorithms, and examines a particular way of promoting their understanding of the mathematical principles underlying the algorithms. The methodological contribution of the study consists of a method for developing operational criteria for identifying and promoting various components of the teachers' knowledge. On the practical level, the findings help in formulating recommendations for improving the ways of teaching the subject, either in professional development programs for teachers or in school settings.

Keywords: Standard algorithms of the four arithmetic operations, mathematical knowledge for teaching

TRANSLATING THE ALGORITHMS OF THE FOUR BASIC ARITHMETIC OPERATIONS INTO HORIZONTAL REPRESENTATION: THE STORY OF ONE TASK

Ira Raveh

This study continues the previous work by Raveh et al. (2016), and focuses on the teachers' learning according to the integrative framework consisting of the core components of the mathematical knowledge essential for teaching the standard algorithms as a holistic and connected subject. The work describes how the teachers' learning process happens and stresses the central role of translating the algorithms into horizontal representation tasks in this process. On the practical level, the findings help in formulating recommendations for designing good learning tasks for promoting teachers' mathematical knowledge for teaching.

Keywords: Standard algorithms of the four arithmetic operations, mathematical knowledge for teaching, task design



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M. Shacham

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