

"Embedded 'Immersion Technology' as a Tool for Harmonizing Fundamental and Professional Training of Future Engineers and Improving the Quality of Their Education"

https://project7369746.tilda.ws/page42826830.html

Yu. P. Pokholkov — Doctor of Science, president of AEER

E. V. Isaeva — PhD, Associate Professor, TPU

A. Vakhguelt – PhD, Professor, TPU

M. Yu. Chervach – Senior Lecturer, TPU

30.09.2026

PROBLEM STATEMENT

- We are going to talk on the 'Immersion Technology' as a way to improve expansion of language and physics-mathematics training and harmonize it with the content of professional training (by involving specialists in language and basic fundamental disciplines in the activities of graduating departments to foster closer interaction and instill in graduates a higher level of language, physical, mathematical and fundamental culture).
- The immersion method—or "embedded technology"—is a unique, innovative, and versatile development created by the team at the Study and Research Center “System Analysis and Management in Engineering Education”.
- It can be used to provide advanced fundamental education for specialists capable of competing in the global market, including in the fields of engineering and technology.
- Concrete empirical results from integrating this method into the educational process are demonstrated through the successfully completed project "Organizing Student Training to Foster Foreign Language Communication Skills within a Professional or Subject-Specific Domain," which will be presented in this report.

Problem statement

- Reduced volume of foreign language teaching assignments
- Insufficient focus on subject-specific and professional content in foreign language learning
- Current learning conditions do not provide the required level of interactivity in the professional sphere
- Overall level of graduates' language proficiency in the professional sphere remains low
- Lack of conditions for developing a language environment at the university

Hypothesis

Integrating English into the learning process and independent study of general engineering and professional disciplines will significantly improve the professional and subject-specific communication skills of TPU students and graduates in English

Professional/Subject-Specific Communication in a Foreign Language (*definition-assumption*)

The ability to convey the correct meaning of professional or subject-specific content to interlocutors and to correctly understand the meaning of professional or subject-specific content expressed by interlocutors.



Core Project Idea

Technologies, tools and controlled characteristics of foreign language proficiency

Classic technologies		Innovative technologies in the project	
Controlled characteristics	Tools	Controlled characteristics	Tools
Reading	Classes, practical sessions	Communication skills	Interactive classes in major disciplines using the "Summary" and "Intensive" formats with professional/subject-specific vocabulary
Writing		Professional/subject-specific vocabulary	
Speaking		General language knowledge	
Listening			

Solutions

"Summary" format
Using English in the final part of each group class in a discipline (10–15 minutes for interactive wrap-up).

"Intensive" format
Active use of English during intensive classes (4 hours per day for 1 week each semester) as part of students' independent work under the guidance of a lecturer..

Staffing
Ensuring that subject lecturers and professional English lecurers involved in the "Summary" and "Intensive" formats have the required qualifications.

Assessment
Organising regular monitoring of students' professional and subject-specific communication skills in English.



Experiment Conditions for Testing the Hypothesis

1. Foreign language: English
2. Various specialist training areas and disciplines
3. Lecturers: professional English teachers and linguists
4. Group size: no more than 15 students
5. Representative sample of student groups.
6. Experiment duration: 3 semesters
7. Assessment: at the start and at the end of the experiment

Experiment Scope

Students in the experimental group: 207

Students in the control group: 188

Subject lecturers – 20

Language lecturers – 2

Engineering training areas – 7

Disciplines – 24

“Summary” format classes – 332 / 88 hours

“Intensive” format classes – 43 / 1,032 hours

Results: Average Student

Final averaged comparative results of assessing students' professional communication skills in English

Communication level of an average student

Groups/Number \ Results		Share of students (%) with a communication level on the scale (0–1)			Average level	Average number/time (hours) of classes attended by students	
		≥ 0,66	≥0.75	≥0,85		«Summary»	«Intensive»
Experimental/ 207	start	61	55	30	0,67	0	0
	finish	79	71	52	0,80	24/6	1/24
Control/ 188	start	28	20	11	0,52	0	0
	finish	37	27	13	0,57	0	0

Results: Comparative Table

Good and excellent results are achieved with 24 “Summary” classes (6 hours) and 24 hours of “Intensive” classes (1 session)

(Experiment, final stage)

Characteristics / Communication range	Average communication level	Students vumber/132	Time in “Summary” classes, hours	Time in “Intensive” classes, hours	Total class time, hours	Share of students not attending classes		Overall average grade	AVERAGE SCORE IN SPECIAL DISCIPLINES of students in group	
						Summary	Intensive		Experimental	Control
0,00 – 0,64	0,46	37	4,3	6,5	10,8	0,15	0,70	3,74	2,99	2,82
0,65 – 0,74	0,71	8	7,4	25,0	32,4	0,0	0.10	3,98	3,83	3,89
0,75 – 0.84	0,80	18	5,5	22,3	27,8	0,25	0,30	3,97	3,56	-
0,85 – 1,00	0,96	69	6,0	33,90	39,9	0,12	0.14	3,95	4,14	-

FINAL PROJECT RESULTS

CHARACTERISTICS: SHARE OF STUDENTS (%) WITH A CERTAIN LEVEL OF COMMUNICATION SKILLS K AND AVERAGE GRADE IN THE CONTROL/EXPERIMENTAL GROUPS (132/115 STUDENTS)

ТОМСКИЙ ПОЛИТЕХ

K range		0,00 – 0,65	0,66 – 0.74	0,75 – 0,84	0,85 – 1,00	Average level
Average level within the range		0,46	0,70	0,76	0,96	
Experimental group/115	Students share	21%	9%	17%	53%	0,80
	Average grade	3,74	3,98	3,97	3,95	3,91
Control group/132	Students share	63%	10%	14%	13%	0,60
	Average grade	3,28	4,24	4,21	4,00	3,98

Conclusions for the project

1. A UNIQUE "EMBEDDED" TECHNOLOGY FOR IMPROVING THE LEVEL OF LANGUAGE TRAINING OF STUDENTS IN TECHNICAL SPECIALTIES has been developed and tested in the real academic process of TPU, which allows, without allocating additional time resources, to ensure a higher quality of training of TPU graduates by significantly increasing their level of communication skills in English in the professional sphere.

Conclusions

2. THE RESULTS of testing the developed technology on representative samples of students during one academic year CONVINCINGLY DEMONSTRATE::

- A higher level of communication skills in English in the professional/subject area of students in the experimental group compared to students in the control group (excess – more than 40%)

- Significant growth in the level of communication skills of students in the experimental group in English in the professional/subject sphere (over 3 academic semesters) compared to students in the control group

Received the highest grades:

- Students of the experimental group – more than 50%
- Students of the control group – 13%

Conclusions

3. The results of students' self-assessment in the experimental and control groups of their level of English proficiency based on the results of the experiment coincide with the objective results of the measurements and can serve as a basis for strengthening students' motivation to learn a foreign language

(Share of students who, in their own opinion, are proficient in English for various purposes: for students of the experimental group – 0.85, for the control group – 0.64)

GENERAL RECOMMENDATIONS FOR ENSURING SUSTAINABLE AND SUCCESSFUL SCALING UP OF PROJECT RESULTS AT TPU

- 1. Use specific measures to stimulate students and lecturers to participate in the project through the use of:
- - a point-based grading system for student learning outcomes;
- - assessment of the results of the lecturer's effective contract;
- financial resources.

- 2. Assign the work on scaling the results of the completed project to the TPU Academic Department and specialists of the relevant structural unit – the Foreign Language Department.

Conclusion

The introduction of the results of the conducted research into broad practice at TPU will allow:

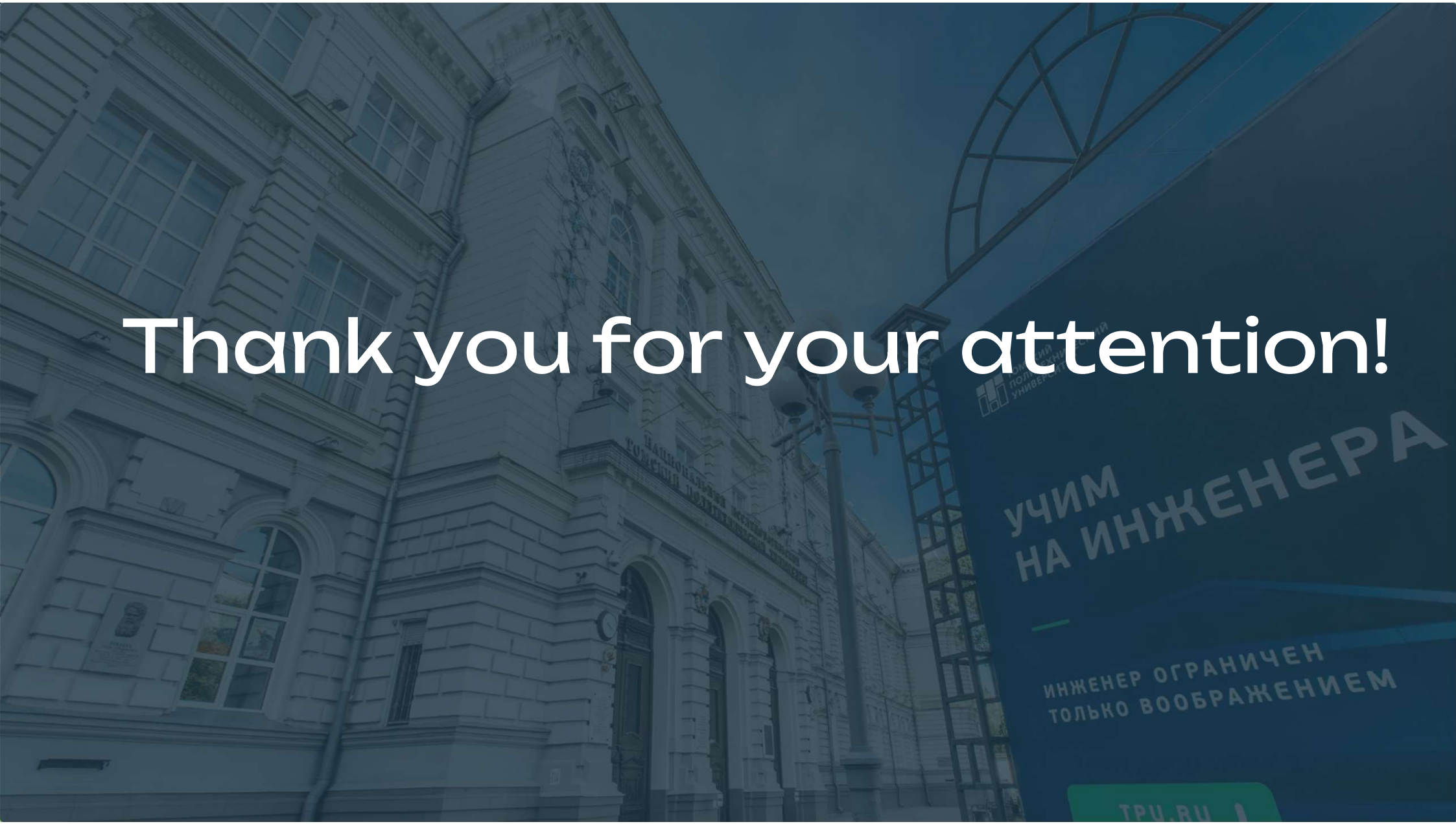
- creating conditions for the development of a language environment at the university;

- strengthening TPU's image as a university whose graduates are more in demand on the engineering labor market, since they are able to perceive and implement the best world practices of engineering activity in Russia and work successfully in international projects;

- increasing TPU's attractiveness for applicants and employers.

EMBEDDED 'IMMERSION TECHNOLOGY (RECOMMENDATION TO USE)

- Based on a preliminary analysis of the problematic situation in training engineers for activities that ensure Russia's technological leadership, the initiative proposes principles and methodology for modernizing the educational process. These principles will significantly improve the level of basic fundamental knowledge in physics, chemistry, mathematics and other fundamental disciplines training and respective culture of future engineers, preparing them for successful professional work in the scientific and digital world and for the creation of fundamentally new technologies and equipment.
- The primary tool for achieving the stated goal and formulated objectives is the proposed integrated professionally-oriented technology of physics, chemistry, mathematics and other training for future engineers. This technology entails more effective, integrated efforts by relative instructors in fundamentals, professional discipline instructors, and representatives of the real economy to enhance the physics, chemistry and mathematics training of students and graduates of engineering educational programs.
- It is expected that the implementation of such educational technology operations will significantly improve the level of basic fundamentals training of students and the relative culture at Tomsk Polytechnic University, significantly distinguishing it from other universities in the country.


Thank you for your attention!
УЧИМ
НА ИНЖЕНЕРА
ИНЖЕНЕР ОГРАНИЧЕН
ТОЛЬКО ВООБРАЖЕНИЕМ