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The Potential of Universities as Resource Centers in the Agile Teacher Training for Organizing STEM Projects for School Students

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Problem statement

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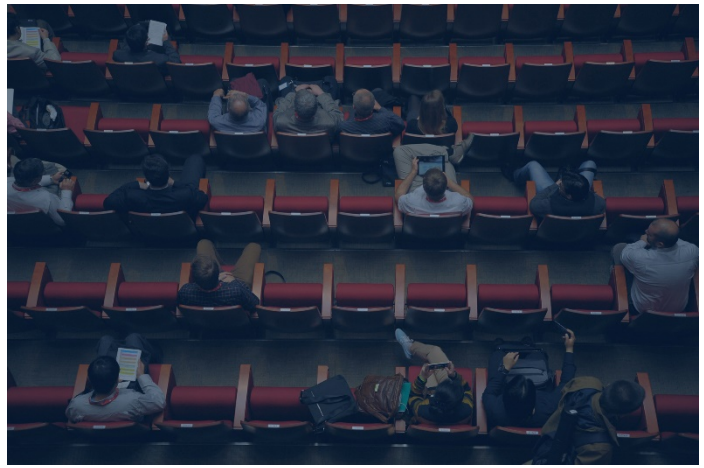
School teachers need to increase skills in evidence-based STEM project education because they have difficulties formulating project assignments, a sufficient understanding of the necessary subject content for interdisciplinary topics, technical and methodological tools, and some other issues.

Tasks are

- comparing and generalizing the experience of preparing teachers for the practical implementation of STEM projects of school students at pedagogical and engineering universities;
- identifying features for adapting interdisciplinary project activities of school educators using agile learning methodology.

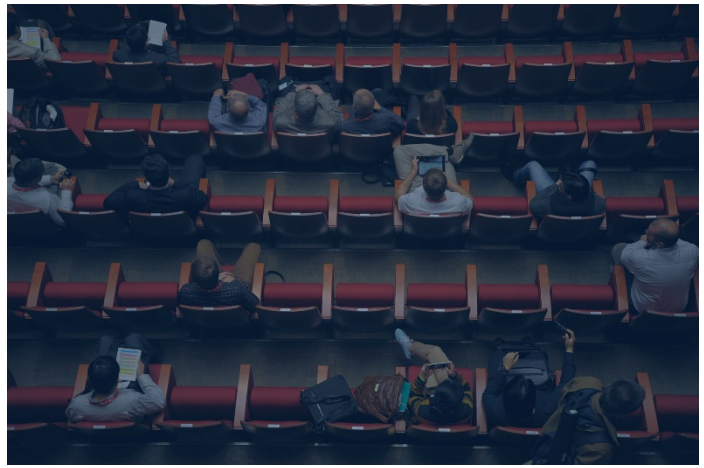
Solution methods

- We compare two cases of teachers' practical training for implementing STEM projects of school students by pedagogical and engineering universities.
- The first case describes short-term school teacher training courses "Digitalization of school education" held at the Department of Mathematics, Physics, Informatics of Shukshin Altai State University for Humanities and Pedagogy for four weeks.
- The second case describes the joint work of representatives of the Department of Engineering Geodesy of Novosibirsk State University of Architecture and Civil Engineering (Sibstrin) and school teachers in a small regional school which was planned for the academic year.



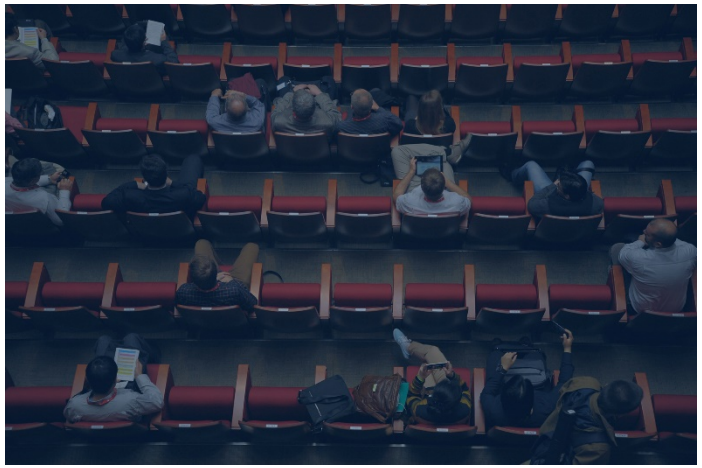
Solution methods

- Case1: Practical tasks for training courses participants (school teachers of different subjects) included blended forms of observation in the organization and support of children's projects by teachers and students of the pedagogical university, when the final task was the development of interdisciplinary STEM project using digital equipment.
- Remote interaction with university educators was carried out in asynchronous modes (forums in Moodle, chats in messengers) and synchronous modes (online consultations and seminars).
- Agile technologies in training were achieved by conducting personalized interviews with teachers to identify problems in organizing project activities while monitoring the interaction with students and university teachers.



Solution methods

- Case2: During the year, there were visits of 7-10 grade schoolchildren with teachers of different subjects to the engineering university and visits of university staff, undergraduates, and graduate students to school.
- The monthly visits schedule has been determined, and the dates for the "profile" program at the school have been set as a five-day intensive, when university teachers, undergraduates, and graduate students come to school. Intensives are planned twice a year; during the year, communication between teachers and university consultants is planned in blended form, at least twice a month.
- To implement an agile learning strategy, before each intensive, a survey of teachers was carried out to clarify the difficulties in implementing STEM project activities when solving their problems.



Results

Diagnostics and Data Interpretation

The answers to the question "What knowledge teachers need?

Some teachers (4 persons) indicated pedagogical activities (development of assessment tools, organization of online collective work, and other), 1 – modeling programs, 1 – means of distance communication, 1 – digital equipment, 2 – new tools in ICT, 2 – no need for new knowledge, only the need for consultation or support in self-learning.

- Case1. The preliminary diagnostics of digital competence included a test questionnaire of factual knowledge and a self-assessment questionnaire. They showed a significant difference in the level of factual knowledge (0-23 points) and the level of self-assessment of ICT competence (1-5 grades), with a steady tendency for teachers to underestimate their level. After individual interviews, it was found that teachers are mainly dissatisfied with their readiness for the practical application of digitalization tools in STEM education.

Results

Diagnostics and Data Interpretation

Only 33% of the respondents suggested ways of further developing projects in their activities and the educational trajectories of school students. The results demonstrate the lack of a sufficient level of theoretical knowledge and practical experience in professional and pedagogical STEM technologies.

- Case2. Survey showed that teachers working as leaders of project teams for the first time, including young teachers, are not sufficiently prepared to use educational material that deepens the school curriculum. Thus, one of problems was associated with understanding the practical interdisciplinary issues of STEM projects.
- Many school teachers had weak skills in searching for information on the Internet and did not know how to formulate search queries accurately enough. The results indicate a demand for renewal and expansion of ICT competency skills.

Implementation

The certification work in teacher training courses consisted of implementing pedagogical design together with students (future teachers of informatics). The work included the preparation of a package of educational documentation and means for collective STEM projects of schoolchildren for the school subject using digital equipment.

The result of long-term six-month support for the professional training of the school staff in cooperation engineering university was the practical implementation of projects of schoolchildren under the guidance of teachers, such as "Model of the school meteorological site," "Interactive plan of the school arboretum".

Conclusions

The personnel and innovation potential of pedagogical and engineering universities can be used to train teachers to implement STEM projects, at least if such work is simultaneously carried out for several teams of the school educators. Such interaction is realized with blended learning, using intensive courses and distance seminars and consultations in synchronous and asynchronous forms.

Therefore, as a prerequisite, teachers must learn to master distant communication and remote support of project activities. It is also essential to have the ability to build computer circuits and models for STEM projects. Blended learning also leverages agile learning strategies with fast and reliable feedback to quickly identify teachers' needs and concerns for personalized learning.

Conclusions

The long-term interaction of the school and the university allows training teachers in the workplace sufficiently so that work with educators' project teams is carried out with a greater degree of independence in subsequent years.

Furthermore, the university is used as a resource center for counseling and short-term training in new technologies.

It is assumed that a long-term effect can be achieved in practical training of educators' teams when working with school students in pedagogical universities, which was demonstrated by the experience of teacher training courses.

Conclusions

Involvement of university undergraduate and graduate students can become a good source for improving the professional competencies of the school staff. Compliance with the condition allows students, on the one hand, to develop pedagogical and collaboration skills, on the other hand, to bring new ideas into the content of school projects while simultaneously reducing the resource labor costs of the university.

The practical significance is the development of cooperation programs for continuous professional training of teachers, teacher training courses based on agile methodology, and blended learning with the involvement of undergraduate and graduate students.

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