

“Be like Izaak Newton”, science project as a method of introducing students with special educational needs to work in a new class in the first year of secondary school during physics lessons

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Abstract. The physics research project "Be Like Isaac Newton" supports students' development through multidirectional activities around concepts such as creativity, innovation and discovery through experimentation. It was planned to increase knowledge of dynamics. The project's experimental set is inspired by the environmental trend of "zero waste." The project combines skills in physics, mathematics, and technical and construction skills. The project was implemented with a group of 19 15-year-olds in the first year of high school, six of whom had special educational needs evaluations.

Introduction

Today, innovation is part of human development strategies. Environmental changes force us to look creatively at development and current solutions to emerging problems. To meet the needs of my students with special educational needs (tab. 1) who are starting to work in a new team, I have prepared a project to introduce these students to work in physics lessons in small research groups through the use of the STEM method while simultaneously implementing topics from the core curriculum regarding dynamics and kinematics.

Theoretical framework

According to RL Billings (2001), inquiry-based learning and constructivist strategies help make the principles and processes of physics "friendly" to all students. Soft skills are abilities to act effectively and achieve desired goals. Supported by psycho-physical and personality traits that develop during the educational process, they have a huge impact on later professional development [1]. They are divided into personal competencies, such as openness, self-acceptance, and ability to cope with stress, and social competencies, such as cooperation skills, communication skills, and personal culture. The need to develop soft competencies is widely discussed in the context of preparing a young person to choose a future profession in an ever-changing world independently.

Methods and findings

In August 2023, in the first grades of high school, I noticed among the school documentation of one of the classes a large number of students with diverse educational needs. I analyzed the results of exams at the end of primary school in the leading subjects: Polish language, English, and mathematics of all first grades. The class with this project had the highest exam results, and students of this class also achieved the highest results in physics diagnosis among the first grade. Surveys were conducted among students on well-being, knowledge acquisition, and cooperation. Solutions in worksheets and analyses of problem questions were analyzed. A guest from a university was invited to conduct a workshop on experiments in physics. Lessons were observed and recorded to analyze students' behavior and competence growth.

The project consisted of several stages. Students built the experimental set (fig. 2 a & b) according to the scheme (fig. 1). They also completed worksheets with tasks of varying difficulty on Newton's principles of dynamics and their application. They also made presentations for other classes.

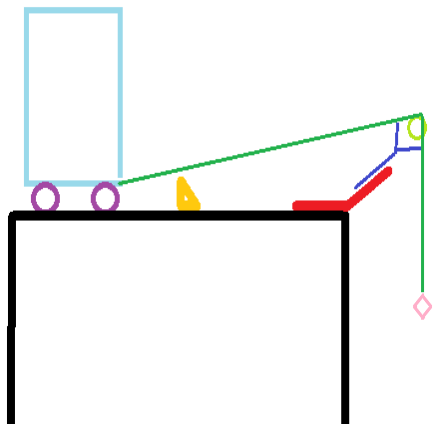


Fig. 1. The scheme of the set

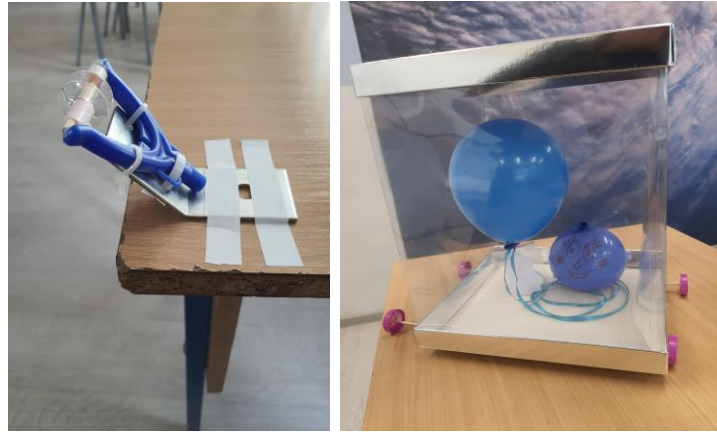


Fig. 2 The set with a). the boom & b). the balloons

The results of the dynamics knowledge test in the project's class were very well after this task: before the project – 47,1% and after the project – 58,6%. Observations and additional activities showed a division among students in different skills types. (tab. 2)

Tab. 1 Types of diagnoses included in the decisions of students with special educational needs.		Tab. 2 The level of activity and the level of knowledge.	
Diagnosis	Number of students	The level of activity and the level of knowledge	Number of students
Autism spectrum	2	The high activity and the high level of knowledge	4
Asperger's syndrome	1		
Disability – hearing loss	1	The average activity and the average level of knowledge	8
Chronic disease – depression (transgenderism)	1		
Developmental dyslexia	1		
Dysgraphia	1	The low level of activity and the low level of knowledge	4
Lack of internal motivation to learn	1	The high level of activity and the low level of knowledge	1

Conclusions

In the project, 19 students began learning physics once a week in a new class at a new educational stage. 30% of this group of students are children with a special education evaluation. They have gained the ability to evaluate information, formulate arguments, and make rational decisions. They can react and find new solutions to difficult and unpredictable situations, which allows them to make informed decisions. As a result, they become more independent and confident in the learning process. These skills bear fruit in achieving considerable success in subsequent projects, where students work with new issues and experiments with dedication.

References

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