Bridging the Gaps: How physics teachers in Slovakia utilize non-formal resources for astronomy education

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Abstract. While astronomy is not a standalone subject in the Slovakian educational system, some astronomy concepts are integrated within Physics courses. This study explores how teachers utilize non-formal educational resources to supplement physics instruction and their perspectives on incorporating astronomy. Data from a survey of 33 teachers reveal that while many recognize astronomy's appeal, time constraints and lack of resources are deterrents. In planning a visit of an observatory, teacher expect lectures, films, and sky observation, with less emphasis on interactive engagement. Findings suggest a need for interventions to enhance teacher awareness of non-formal astronomy resources and promote interactive teaching methods.

Introduction

Astronomy is considered by many experts to be an attractive gateway to the world of science and scientific research by its cultural and historical context, interdisciplinarity, and modern technologies [1]. In Slovak educational system, there are no compulsory courses explicitly focused on astronomy. Selected concepts and phenomena connected with astronomy are taught within formal education as part of Basics of Natural Sciences (primary education), Geography and Physics (lower and upper secondary education). Specific study of astronomy is available in optional courses at upper secondary schools. [2] Within Physics course the current state curricula does not include explicit astronomical topics.

The currently verified state curricula that should enter into general application gradually from the school year 2026/27 includes within lower secondary physics selected parts of astronomy. Developed concepts are [3]: Solar system and space bodies in it, astronomical unit, model of the Solar system, mutual movements of the Sun, Earth and Moon and their relationship with the length of the year, month and day, stars, planets and moons; Azimuth and altitude, sunrise and sunset at different times of the year, starry sky during the day and throughout the year.

Research questions and methods

Although the current state curriculum in physics does not include astronomy topics, there are numerous opportunities of non-formal education (e.g. public observatories and planetariums, exhibitions, knowledge competitions for pupils and students, astrophotography competitions, summertime astronomical youth camps) from which physics teachers and their pupils can benefit.

As part of a broader research, we asked whether physics teachers currently present astronomical topics to their pupils and students, and if so, in what way. We were particularly interested in what from the non-formal education offer teachers use to supplement the prescribed minimum content of school physics and how they envision a “dream” visit to an observatory and planetarium.

Data were collected during professional development conference for in-service physics teachers in 2023 using a paper-pencil form of an open-ended questionnaire. Participation in the survey was voluntary and anonymous. Answers of 33 teachers (15 lower secondary, 11 upper secondary, 7 lower and upper secondary) were collected. Content analysis and descriptive statistics were used as response analysis methods.

Preliminary results

Of the 20 respondents who include astronomical topics in their physics instruction, explanatory approach was the most common (n=16). Ten teachers utilize computer simulations, while seven incorporate astronomical observations. Project-based learning is implemented by five teachers, and only one teacher includes measurement activities.

To supplement their physics curriculum with astronomy content, eleven teachers utilize excursions to observatories or planetariums, while seven teachers invite guest lecturers with expertise in astronomy. Interestingly, five teachers who do not integrate astronomy into their core physics classes still utilize excursions to expose students to astronomical concepts.

The primary rationale for incorporating astronomy into physics lessons is its inherent appeal and ability to capture student interest. This was the most frequently mentioned reason by both groups of teachers: 10 of 13 who include astronomy, and 13 of 20 who do not. Teachers who actively integrate astronomy provided more nuanced justifications for its inclusion: interdisciplinarity (n=3), physics knowledge integration (n=2), everyday life connection (n=2), and introduction to current science.

The most common barrier reported by teachers who integrate astronomy was a shortage of instructional time within the existing physics curriculum (n=10) and a lack of appropriate teaching materials (n=3). Among teachers who do not integrate astronomy, the most frequent reasons cited were time constraints (n=4). Three teachers expressed concerns that the topic might not be interesting for all pupils.

The survey revealed a preference for traditional educational approaches during observatory and planetarium visits. The majority of respondents envisioned a visit incorporating lectures, films and sky observation. Interestingly, only nine teachers expressed a desire for an interactive program, e.g. workshops or hands-on activities where students actively construct their understanding and develop skills through modelling.

Conclusion

Although the research sample was small, the fact that the data were collected from engaged teachers at a professional development conference suggests that in-service teachers are not sufficiently familiar with the possibilities of non-formal education in the field of astronomy. A specific intervention should be developed not only to help teachers to benefit from non-formal education but also to use non-formal methods in future teaching of astronomy within physics classes.

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References

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