

INFORMAL STYLE IN MATHEMATICS TEACHING

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Abstract. This article presents some possibilities for inserting an informal style of learning into a classical mathematics lesson. The concepts used are clarified – formal, non-formal and informal learning, and the characteristic communication style in informal learning. Some studies are presented, aimed at the benefits and possibilities of non-formal and informal learning for increasing mathematics achievement in formal learning. Various examples are given, in an informal style, which can be implemented in a classical mathematics lesson. In the article, the focus is on the application of elements (dialogues, texts, images and videos), atypical for a classical mathematics lesson and distinguished by an informal style of communication and presentation of information. The main idea of this approach is for the teacher to enter the surrounding environment in a non-formal way, as a bearer of a non-standard view of mathematics. The goal is for the student to have internal motivation to have fun with humor with a mathematical subtext. Specific examples are given and methodological guidelines for their application in formal learning are described. The aim of the study is to analyze the didactic potential of elements of the informal style in mathematics education. The study is guided by the hypothesis that the purposeful use of informal style (humor, visual memes and dialogic texts) is accepted by teachers and similar examples should be given in the preparation of future teachers. The article is based on the opinion of 230 mathematics teachers and observations on the work of future teachers. The study shows high acceptance of humorous and informal elements in the classroom.

Keywords: informal learning; non-formal learning; informal style; mathematics; images; humor

1. Introduction

Non-formal learning is based on the idea that knowledge can be acquired outside the standard classroom and in contexts that are related to real life.

According to Dewey (1938), learning is most effective when it is active, engaging, and related to the personal experience of the learner. A classification aimed at dividing formal and non-formal learning styles was indicated by Bennet (1976). Active methods and voluntariness in engaging in the relevant learning are characteristic of informal education. In the context of formal education, subject to the competency approach, we should note that recently, game approaches, the use of technology, the integration of cross-curricular connections, and the insertion of humorous elements into the classic mathematics lesson have been strongly introduced.

Modern education is increasingly aimed at applying non-formal approaches, methods, and styles in formal education. There are numerous opportunities to capture students' interest with non-standard tools in a classical lesson – gamification of learning (Stoyanova et al., 2016), insertion of attractive 3D images (Harizanov & Ivanova, 2020), using tangible objects for learning (Mustan, 2025), using specific methods for assessment (Uzunova-Dimitrova et al., 2023) and many others.

In this article, we will focus not so much on the methods characteristic of individual types of learning, but on the style of written and oral communication and the use of entertaining images when implementing a mathematics lesson in its classical form.

2. Terminology

For *formal/official education* we will adopt the following definition: *Formal education refers to the structured education system that runs from primary (and in some countries from pre-primary) school to university, and includes specialized programs for vocational, technical, and professional education and training.* (Dzelalija, 2022). Formal learning is learning that follows a specific program and is offered in an educational institution. It is planned and led by a trainer/s and is usually delivered face-to-face or via an online learning platform.

For *non-formal education* we will adopt the following definition: *Non-formal education (or learning) refers to planned, structured programs and processes of personal and social education for people designed to improve a range of knowledge, skills, and competencies, outside the formal educational curriculum.* (Dzelalija, 2022). Non-formal learning takes place outside the

formal learning environment, but within some organizational framework. It arises from the conscious decision of the learner to master a particular activity, skill or area of knowledge and is therefore the result of deliberate effort.

We should also clarify the concept of *informal learning* – *Informal education refers to a lifelong learning process, whereby each individual acquires attitudes, values, skills and knowledge from the educational influences and resources in his or her own environment and from daily experience. People learn from family and neighbors, in the marketplace, at the library, at art exhibitions, at work and through playing, reading, and sports activities. The mass media are a very important medium for informal education, for instance through plays and film, music and songs, televised debates and documentaries. Learning in this way is often unplanned and unstructured.* (Dzelalija, 2022).

By *non-formal writing style*, we mean a form of communication that is... *casual, relaxed, and conversational. It is used to communicate with friends or people you are familiar with, but it can also be used to influence that relationship, as in persuasive writing or advertising.*

In the context of mathematics teaching we can say that informal style is a pedagogically controlled communicative strategy that departs from rigid academic discourse toward everyday-life positive emotions, while preserving mathematical accuracy and instructional purpose.

*Informal writing imitates the way friends speak in person, using verbal communication tools such as slang, abbreviations, and acronyms, as well as idioms and colloquial expressions.*¹

The informal presentation of some math concepts gives students the possibility to use an intuitive foundation that supports, motivates, and contextualizes the subsequent formal presentation.

However, it should be noted that this informal presentation is only supportive of the classical way of introducing mathematical concepts. It aims, on the one hand, to evoke positive emotions related to mathematics, and on the other hand, to stimulate students to think critically and independently search for mathematical jokes, which contributes to their

interest in mathematics and an in-depth understanding of some mathematical knowledge.

Modern learning increasingly borrows methods, tools, and manner of communication, characteristic of non-formal learning. The non-formal style of learning differs from the formal one in its flexibility and emphasis on learning through experience and exploration. Informal learning, on the other hand, is more spontaneous and often outside a structured educational environment.

3. Methods

The empirical component of the study was conducted in 2024 and involved 230 mathematics teachers from different educational levels. The study aimed to explore teachers' attitudes toward and self-reported use of informal stylistic elements (e.g., humor, memes, informal visualizations) in mathematics teaching.

The research design is descriptive and it includes some case studies from practice with preservice teachers.

Data collection tools are an anonymous questionnaire and the observation of students' activities.

The focus of the analysis is on the frequency of use of informal elements in math lessons and interest in further methodological support.

Analytical methods include descriptive analysis of the quantitative data and a qualitative interpretation of open-ended responses and observation cases.

4. Informal style in mathematics teaching

There is a wealth of research focused on the potential of non-formal and informal learning to enhance students' mathematical literacy. We will note some key findings such as: *“There is strong evidence that children and adults regularly engage in mathematical thinking and learning outside of school, in both everyday and professional settings, as well as designed informal learning environments, such as interactive exhibits.”* and *“Mathematical thinking and learning outside of school is often done in a social context in which social mediation and facilitation, such as guidance by a parent or caregiver in a*

family setting, are an important aspect of the experience. (Pattison et al., 2017).

The majority of the research included in the review cited above focuses on informal learning, taking place outside the school environment. (Civil, 2002; Eloff et al., 2006; Esmonde et al., 2013; Goldman & Booker, 2009; Hoyles et al., 2001; Kliman, 2006; Martin et al., 2009; Martin & Gourley-Delaney, 2014; Masingila et al., 1996; Nasir, 2000; Nunes & Bryant, 2010; Nunes et al., 1993; Roth, 2011; Saxe, 1991; Taylor, 2009) and on the influence of the everyday environment on students' interest in mathematics (Lopez & Donovan, 2009; Mokros, 2006; Civil & Bernier, 2006; Guberman, 2004; Rogoff et al., 2003).

In this article, we will focus on the application of elements (texts, dialogues, images, and videos) that are atypical for the classical mathematics lesson and are distinguished by a non-formal and informal style of communication and presentation of information. The idea is that in this way the teacher will enter the surrounding environment in an informal way, as a bearer of a non-standard view of mathematics. The emphasis is placed on speech and images with a humorous element.

A survey conducted in 2024 among 230 mathematics teachers revealed that 89% (fig.1) of them consider it useful and use humorous elements in their mathematics lessons.

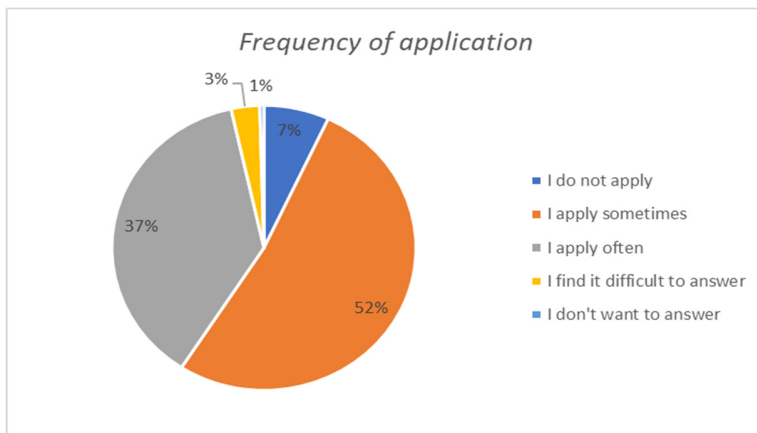


Figure 1. Frequency of application of humorous elements in math lessons
(Source: Author's own elaboration)

Teachers shared their interest in learning about new opportunities for integrating such fragments into a classical mathematics lesson. The use of video lessons for self-training and overcoming gaps by students is also taking place on a large scale, as these materials often use an informal style and lax adherence to the principle of scientificity, unlike the classical lessons. However, we believe that the informal style of learning should follow the mathematical accuracy of the material and clarification of the correct terminology.

5. Examples from books and the Internet

Although the frequent use of the informal style in education has come relatively recently, examples of its application and materials supporting such an approach have been known for a long time. We will note the book *Oh, this mathematics!* in which a number of mathematical concepts are described in an accessible and entertaining way in the form of an *imitation dialogue* between the author and the reader, supported by illustrations. For example, Shporer illustrates the concept of non-Euclidean geometries through fig. 2. He also introduces a humorous element with the comment “... and I remember very well how my classmate Peter got a deuce by saying that the sum of the angles in the triangle is 150° ...” (Shporer, 1985).

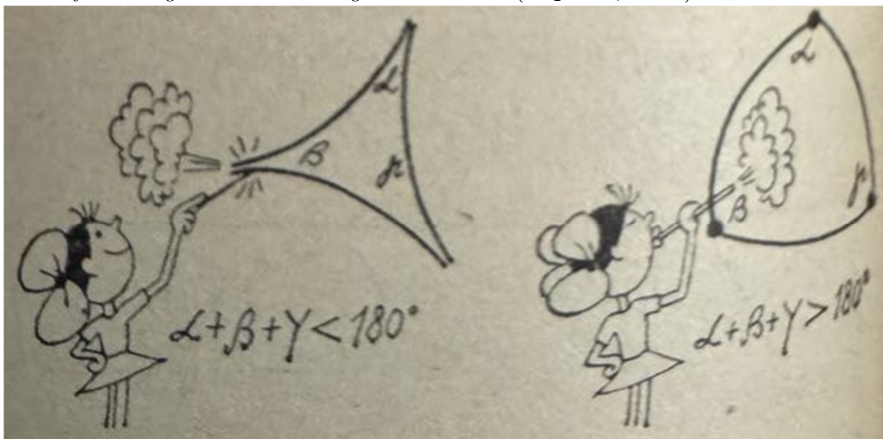


Figure 2. Example of a triangle in non-Euclidean geometry (Shporer, 1985)

A peculiar style, directed towards art and nature, is also chosen in the book *Geometric Rhapsody* (Levitin, 1976). The author connects geometric concepts with the work of a number of famous artists and continues the parallel to the natural sciences and the world around us. Authors such as Martin Gardner (Gardner, 1994) and Hugo Steinhaus (Steinhaus, 1970, 1974) also made a great contribution to the popularization of mathematics, using an informal style and funny illustrations in their works. Among the contemporary Bulgarian publications, we would like to mention *Rebel's Guide to Failing Math Class* (Stancheva, 2018). The names listed above are a small part of the mathematicians who pay attention to the problem of “bringing” mathematics closer to students. These works can be integrated into the activities inherent in formal education.

Along with the classic ideas presented above, modern technologies and the needs of the alpha generation also suggest the use of a number of visual elements. For example, memes popular on social networks can be included as an element of a classic math lesson when they are mathematically oriented. *An Internet meme (also called a meme; in English: Internet meme) is a type of meme that spreads on the Internet, often through social media platforms and especially for humorous purposes. Memes spread from person to person through social networks, blogs, email, or news sources. They can be related to a number of existing Internet cultures or subcultures, often created or distributed on various websites.*²

The images below provide several examples that can be used not only to lighten the atmosphere in class, but also as a mnemonic tool or to provoke a desire to independently solve problems and formulate hypotheses. *Using ready-made mnemonic rules is useful, but creating one's own mnemonic techniques, both in the learning process and in everyday life, puts the individual on a higher level and affects important skills such as criticality, creativity, and the ability to deal with practical tasks. Mnemonics are a fun method that, once mastered, allows the individual to further develop it in all forms and spheres, and facilitate memorization in perspective.* (Toncheva, 2024)

The image in fig. 3 can be used both as a mnemonic tool and as an idea on the basis of which students can create their own memes, presenting the

concept of “inverse function” in a fun way. Such a task can be set for homework with a voluntary nature or in the form of a competition for which no time from the lesson will be used.

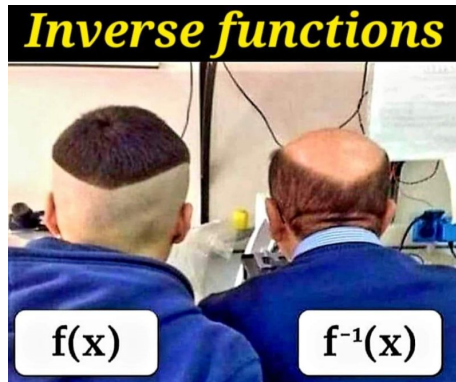


Figure 3. Inverse function³ (Author unknown)

The example is intended for the course of calculus or extracurricular forms of training in high school. It aims to provide a conceptual understanding of inverse functions with the help of an attractive example. The possible negative consequences are expressed in the implementation of a superficial analogy without delving into the essence of the concepts.

The image in fig. 4 could be the final to a lesson on the Pythagorean theorem or when studying isosceles and equilateral triangles. On the other hand, the image could also be a kind of problem-task at the beginning of the corresponding topic.



Figure 4. Pythagorean Theorem³

This example can be used in middle and high school to remind students of the types of triangles, and reinforce the Pythagorean theorem. This illustration concerns simple mathematical concepts and is not expected to have a negative cognitive effect, misunderstanding, or waste of time.

The image in fig. 5 can provoke students to think about arithmetic operations and stimulate their inductive thinking. The given idea may vary for different age groups and for different topics, depending on the selected expressions. The possible risks are that students may find it difficult to formulate their own examples of this type. In this way, valuable time may be lost if such an assignment is given within the lesson. For this reason, it is good to leave such examples as an idea for a mathematical cartoon project to be developed as homework.



Figure 5. War or peace?³

The examples used in the article are borrowed from books and from the Internet. Some of them were suggested by the teachers participating in the survey and the observed preservice teachers.

The didactic examples included in the paper were selected based on the following criteria:

- mathematical correctness and alignment with curriculum content;
- presence of informal stylistic elements (humor, visual exaggeration, dialogic or meme-based form);
- potential didactic function, such as conceptual clarification, mnemonic support, motivation, or discussion stimulus;
- cultural relevance to contemporary students;
- adaptability to formal classroom instruction without compromising instructional goals.

The Internet is full of such examples that can be used in a ready-made form, modified according to the goals of the lesson, or created independently by teachers and students. By using such memes in a classic mathematics lesson, the teacher can provoke students' internal motivation for informal mathematics learning by creating and sharing mathematical memes on social networks. It should be noted that such a desire is rarely manifested in most students.

6. Examples of informal elements of good practices and student projects

We will point out several examples, with an informal context, that have been observed in methodological developments and course works of students—future teachers—and examples provided by current teachers.

A large part of the teachers who participated in the study shared that they do not prepare specific examples, but use existing situations whenever there is such an opportunity. Other colleagues use ready-made examples described by established specialists. For example, the book *Mathematical Folklore* with authors Ivan Ganchev, Kiril Chimev and Yordan Simeonov, classic examples such as “Pythagoras' pants”, use of funny objects for illustration purposes, etc.

Students remember jokes like “100 cattle – When Pythagoras discovered the famous theorem, he slaughtered 100 cattle in sacrifice. Since then, the cattle have hated mathematics.”, “In mathematics class, a teacher gives a task: “You have 100 dogs, someone takes two of them, how many are left?” The students answer, “Another 100 dogs, but one corpse!”, etc. Practice shows that they rarely remember thematic cartoons, but after they are shown to them, they begin to independently look for suitable examples. When choosing a topic for a term paper, in cases where they have such freedom, students most often choose clear and concise topics, but those with in-depth knowledge also choose non-standard topics, such as “Sherlock Holmes and his methods – examples of reasoning”, “Sophisms in teaching

mathematics”, etc. On the first topic, the student analyzes the methods of induction and deduction, giving both his own examples, and examples from the works of Arthur Conan Doyle. The second topic presents examples of sophisms and analyzes the errors and methodological possibilities for applying these examples in teaching, such as the classic sophism “how to prove that $1 = 2$ ”, in which the goal is for students to once again understand that it is not possible to divide by zero. The proposed reasoning is:

1. Let $a = b, b \neq 0$
2. Multiply by a and we get $a^2 = a \cdot b$
3. Subtracting b^2 , we get $a^2 - b^2 = a \cdot b - b^2$
4. Then we get $(a - b)(a + b) = (a - b)b$
5. **Dividing by $(a - b)$, forgetting that $a = b$**
6. We get $a + b = b$ and remembering that $a = b$ we get $2b = b$
7. So, $2 = 1$

The student offers similar examples of the application of sophisms, both when considering a ready-made “proof” and when presenting it by a teacher in real time and conducting a discussion to detect the error. Within the framework of the discipline “Methodology of Mathematics Education”, students are asked to explain cartoons such as those in fig. 2, 3, 4 and 5 and to comment on where and how they would apply them. As a challenge, they are also asked to find similar, or create their own cartoons that would have applications in mathematics education.

Among the proposed examples are those that concern more in-depth material, such as fig. 6.



Figure 6. Math joke⁴

7. Opportunities

Fragments of literature aimed at popularizing mathematics by using an informal writing style and visualizing examples, as well as images similar to the memes presented above, have a place in classical mathematics lessons, as a complementary element, or as an idea for a discussion in a classical lesson. Videos describing mathematical material using informal expression are widely used in self-preparation and filling in the gaps by students. We believe that this process can also have a deeper side in cases where students are provoked or independently begin to look for an opportunity to create their own mathematically oriented memes.

8. Conclusion

The requirements and characteristics of each new generation change and it is often difficult to cover all aspects of the organization of the learning process. *Student motivation has emerged as a major issue in mathematics education in recent years. Utilizing the capabilities of contemporary technology and the accessibility of a STEM environment is crucial for the creation and application of educational materials* (Karashtranova et al.,

2024). The global trend is for training to be directed in a practical and applied direction. For this purpose, work is being done on the implementation of STEM training and the application of the competency approach. At this stage, it is important to use not only methodological techniques to stimulate interest and motivation for studying mathematics, but also psychological techniques that increase interest and a positive attitude towards the subject. The use of humorous elements and the use of an informal style in some lessons is applied by teachers and leads to a lightening of the atmosphere and a reduction in the stress among students, but it is important, when applying this style, to ensure compliance with the principle of scientificity and the purposeful and conscious insertion of such fragments.

NOTES

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