

HUMOUR AS MEANS TO MAKE MATHEMATICS ENJOYABLE

Pavel Shmakov & Markku S. Hannula

University of Helsinki & University of Turku, Finland

The traditional educational system is constructed in such a manner that it excludes humour as a unique live process for promoting knowledge and understanding. Informational communications is the basis of logical thinking instead of vivid dialogue that has an informative purpose. Present work represents an intermediate stage of research of influence of CheCha math method. In particular, humour as the affective factor in mathematical reflection is being considered. With the use this method, the positive emotions that result can influence how teaching material is perceived, can facilitate creation of joyful atmosphere in the classroom, and can help maintain creative state of mind in students.

Key words: problem solving, emotions, humour, classroom climate, motivation

INTRODUCTION

"...the comic thought, which with contradiction, and is strengthened by imagination, is capable of delivering pleasure by training and induces the pupil to participate in dialogue... Game and laughter are higher expressions of living and rejoicing of life" (Muñiz, 1996).

Anyone who has paid attention to great speakers would know that humour is an excellent method for eliciting sympathy from the audience and opening them up to your message. Every teacher also knows that a sense of humour is necessary to winning the hearts of students. Research has established that one's affective state has an effect on cognitive processes (see e.g. Hannula, 2006). How should this inform teaching? Should the teachers focus on creating an entertaining show for their students? Or would the teachers change their lessons into therapy sessions?

This study presents a teaching approach that is built around math problems that are for the student at the same time **Cheerful** (entertaining, funny, cool) and **Challenging** (difficult). We call this CheCha mathematics.

THEORETICAL FRAMEWORK

CheCha math method is based on three educational approaches: acknowledging the role of affect in math learning (Hannula, 2006), using humour in teaching (Grecu, 2008) and use of open-ended problems in math teaching (Pehkonen, 2004).

Affect in mathematical thinking and learning

In order to study affect in math education in contexts of actual classrooms there are three main elements to pay attention to: cognition, emotion, and motivation. Achievement without motivation is not sustainable, and neither is motivation without

enjoyment. All three domains have a more rapidly changing state-aspect and more stable trait-aspect. (Hannula, 2006)

One "fundamental principle of human behavior is that emotions energize and organize perception, thinking and action" (Izard, 1991). Research has confirmed a positive relationship between positive affect and achievement. It seems that the affective outcomes are most important during the first school years, as they are less likely to be altered later on. Two key elements of a desired affective disposition are self-confidence and motivation to learn (Hannula, 2006).

Advances in our understanding of the neuropsychological basis of affect (e.g. Damasio 1995, LeDoux, 1998) have radically changed the old view of the relationship between emotion and cognition. Emotions are no longer seen as peripheral to cognitive processes or as 'noise' to impede rationality. Emotions have been accepted as necessary for rational behaviour. Moreover, research has also shown – although not yet fully understood – that certain emotions facilitate certain type of cognitive processing (Linnenbrink & Pintrich, 2004).

Focusing on motivation we may find ways to influence what the subjects want to do, not only how they try to achieve it. In the existing literature, psychological needs that are often emphasized in educational settings are autonomy, competence and social belonging (e.g. Boekaerts, 1999). These all can be met in a classroom that emphasises exploration, understanding and communication instead of rules, routines and rote learning. However, this requires that all feel safe and perceive that they can contribute to the process. A possible approach to meet all these conditions would be the open approach, and more generally focusing on mathematical processes rather than products (Hannula, 2006).

Humour

Already Kant (1952) considered the nature of humour. He stated "Laughter is the result of expectation which suddenly ends in nothing" (p. 199). His classical statement has started considering humour as a mental mechanism resulting in laughter. As another early scientific approach to humour, Freud (1991) divided comic into wit, humour and actually comic. Many kinds of activity, including wit, are directed on reception of pleasure from intellectual processes. A person feels pleasure from suddenly released energy, which is splashed out in the form of laughter. From this perspective already, we can perceive how a good joke can generate a joyful atmosphere and create a positive emotional background of activity.

The comic, humorous contents can be reached in various ways and techniques. For example, Veatch (1998) suggests a list of types that are funny: finishing to the point of irrationality, satire, literal understanding of metaphors, irony, ambiguity, word-play, contradiction, discrepancy, excessive rationality and a deviation from the usual.

Each of these types of the comic can be expressed as a joke or a problem in math context. As an example of a math contradiction we take a joke, here framed within the world of Winnie the Pooh:

Pooh and Piglet sit on a small bench and talk. Eeyore has sent them a box. In the box there are ten sweets and a note. In the note Eeyore tells them to divide them: seven for Pooh and seven for Piglet. Piglet: "How is that? I do not understand. What do you think of it?" Pooh: "I do not even want to think. But I have already eaten my seven sweets".

Humour can also act as means of a psychological discharge, and promote efficiency of pedagogical activity. Suhomlinsky (1975) wrote:

I would name laughter as a back side of thinking. To develop ability to laugh in the child, to enhance his sense of humour - means to strengthen his intellectual forces, abilities, to teach him to think and to see the world wisely.

Greco (2008) has considered use of humour in teaching. She highlights seven basic functions of humour in pedagogical activity:

- 1) informatively-cognitive (Opens essential features and properties of subjects and the phenomena. Rejecting standard approaches, the humour bears in itself any discovery),
- 2) emotional (the Humour can act as means of creation of creative state of health and as means of emotional support)
- 3) motivational (The humour can serve as a stimulator of volitional processes)
- 4) communicative (the Person with humour is attractive for people)
- 5) developing (Humour promotes development of critical thinking, a sharpness of vision of the world, observation and consequently intellect)
- 6) diagnostic (by the laughter maintenance - at what the person laughs, it is possible to judge about his merits and demerits) and
- 7) regulative (the humour gives the chance to look at oneself from an unexpected angle, allowing self-evaluation).

In CheCha method most of these are relevant, the most important functions being on top of the list. Greco suggest the following techniques for designing of humour for educational tasks. These pedagogical techniques are paradox, finishing to the point of irrationality, comparison by the remote or casual attribute, return comparison, wit of absurd, pseudo-contrast or false opposition, a hint, a self-exposure of own faults, intentional ignoring of things that might cause laughter, and exaggeration of the certain features of behaviour.

Greco has offered also classification of means of the comic: 1) "word-play" based on violation of language norm (carrying of terminology over to a context unusual to it). Consider the following riddle: "*I am it while I do not know that I am. But I am not it when I know that I am. What am I?*" 2) Comparison, author's original neologisms, - based on artistic expressive means (double entendre, an ambiguity). Examples are

easy for finding in Carroll's books (2006, s. 50): “*Explain yourself!*” “*I can't explain myself.*” 3) Paradox, an example being the claim “*I am lying now*”.

Also Dzemidok (1993) distinguishes several humoristic methods: modification and deformation of the phenomena, unexpected effects and amazing comparisons, disproportion in attitudes and communications between the phenomena, imaginary association of absolutely diverse phenomena, creation of the phenomena which deviate from logic. As an example of the latter method consider the following:

There were only 3 students attending a professor's lecture in University. Suddenly 5 persons left the room. The professor said: "If 2 students enter this room, there is nobody attending."

Most types of humour and their techniques could be used at mathematics lessons. Thanks to entertaining tasks and comical contents of the problems the classroom climate promotes a positive interaction between the teacher and students. However, one must be aware that opportunities of humour as pedagogical means have their limits. Grecu (2008) gives several suggestions regarding these limits. She suggests that one should use humour gently and support humour of students. She also warns not to ridicule student's person, laugh at what the student is not able to correct or change or laugh at an involuntary mistake of the student. Rough joking would indicate lack of customs and disrespect of the student and hence is absolutely unacceptable for the teacher. Moreover, the teacher should avoid being the first to laugh at one's own joke, as it can cause the reaction opposite to expected.

Problem solving and open-ended problems

Problems are said to be open, if their starting or goal situation is not exactly given and they usually have several correct answers (cf. Pehkonen 2008). Open-ended problems emphasize understanding and creativity (e.g. Nohda, 2000, Stacey 1995). This would not mean lowering the expectations, quite the contrary. If an open task allows the solver to gain deeper and deeper insights (a "chain of discovery"; Liljedahl, 2005) it can facilitate a state of sustained engagement. This would also lead to more intensive working.

Research has shown that problem solving can be engaging and enjoyable for many students, but it does not attract everyone. Schoenfeld (1985) defined an individual's beliefs or "mathematical world view" as shaping how one engages in problem solving. For example, those who believe that math is no more than repetition of learned routines would be more likely to give up on a novel task than those who believe that inventing is an essential aspect of maths. Unfortunately, there are students who do not see the potential for engagement and enjoyment in a math problem. We see humour as a means to engage also those students who do not perceive math problems enjoyable to begin with.

THE FEATURES OF CHECHA MATH

This research is more about creating tools for teaching than about analysing the reality of classrooms. The work has been started based on the first author's pedagogical intuition as a teacher and his will to engage students with math. This research falls within didactical engineering (Artigue, 1994) or design research paradigm (Cobb, Confrey, diSessa, Lehrer, & Schauble 2003) and it has a clear practitioner approach: "How can the teacher use humour to engage students' interest in math?" Previous experience in teaching had shown that information, when presented in humoristic form, is more convincing and is more easily acquired. This approach has developed gradually over a few years into a teaching approach that assumes:

- * in the same assignment entertainment is combined with a set of difficulty levels;
- * during problem solving there are conditions for emotions to rise;
- * all students can participate actively in solving the assignment regardless of their abilities.

The educational space is constructed in such a manner that teamwork of the teacher and students accepts dialogue character and interest in mathematics is favored. While using CheCha method, we separate the following basic constructs: a) *entertainment in learning process*, b) *level of the problem's difficulty*, c) *plurality of problem solutions*. We refer to as *entertainment in learning process* the affective components which excite the interest, draw attention and/or create a joyful atmosphere. For example, as entertainment we assume appeal, extraordinary content, intriguing title and/or amusing formulations. *Level of the problem's difficulty* we define as the variable degree of solution's complexity, beginning from the "obvious", achievable for many children, proceeding to a more complicated. It is important that the simplest way not always guides to the right solution. *Plurality of problem solutions* is a construct that consists of variety of means and ways of solving problem on the same level of abstractness, understanding and complexity. Various approaches are possible in one problem and it is supposed to have both a set of ways of solving and sets of different solutions as a whole. For example, to create a problematic math situation such parameters, as incomplete condition, the overloaded contents, or introduction of "not existing in reality" factors are used.

RESEARCH METHODS

In this paper, we shall describe the method of creating mathematical assignments (CheCha problems) and evaluate the practice of CheCha math teaching. We explore

1. What mathematical problems are entertaining from the students' point of view?
2. How CheCha method influences the atmosphere in mathematics lessons?

The construction of CheCha problems

The technique of construction of such problems consists of certain stages. At the initial stage there is a search of "matrix" of a condition or its author's creation. Useful sources to find problems that can be developed into CheCha problems have been math jokes, E. Lear's (e.g., 2002) and L. Carroll's (e.g., 2006) books, collections of problems from math Olympiads. Chessboard has also been a good setting for such problems. The original problem is typically open or can be modified into an open problem, meaning that it has no unique and final solution.

The next principle is to consider age-typical interests of students, their specific personalities and personal preferences. Substantial richness of a context of a problem is carried out at a following stage. There is a transformation into a context that bears in it entertainment, extraordinary and comic flavour or lively situations. At the same time, level of difficulty and plurality of the solutions is considered, allowing a wide range of different levels of solutions and approaches.

Then the problem is introduced to students and there is the opportunity for feedback, which is stirring up cognitive activity through questions, solutions and discussions. The teacher observes and reflects upon students' thinking during problem solving, focussing on: the perception of a problem by students (acceptance or non-acceptance); questions asked by them (depth and breadth); a degree of understanding of the context. These help the teacher to find direction for task's development.

It is important to notice that for every area of math teaching and learning one can find or construct such CheCha problems. This may lead to creation of a new problem, or changing of the task. For example: *“Three tortoises go one after another along the road. The tortoise says, “Two tortoises follow my rear”. The second says, “One tortoise goes ahead”, “One goes back of me”. The third says, “Two are ahead”, “One creeps behind”. How can this be?”* One should note that this problem is more attractive than something about moving material points along a straight line, with particular coordinates. The most common answer here is that it is impossible. But, in fact, there can be the solutions. *“Three tortoises go...”*: the words of the third tortoise contradict each other. The solution might be that the last tortoise is lying! ...One tortoise is riding on another. ...There is a time lapse between the phrases, allowing one tortoise to run ahead. ...The fourth tortoise stays near or behind the last turtle, and begins moving after the first phrase of the third turtle... The road is circular... The road is triangular... There is a mirror behind the last turtle. When it looks at its back, it can see one more turtle. Progressing from considered examples, and, instead of tortoise, we turn to another object, e.g., cows. One more possible solution is the birth of a calf!

Using CheCha problems in teaching and feedback from students

Research was carried out in two Finnish schools (Espoo 2007-08 and Helsinki 2008-09), in 7th classes with different level of acquaintance with CheCha math method and various educational atmospheres. The first author was teaching in these schools.

1. In December, 2007 the first author surveyed students' preferences of entertaining features in maths. The questionnaire consisted of five questions of open and closed types, e.g. *"What in a math problem can be entertaining?"* Two questions were multiple choice questions concerning the respondents' view of entertaining maths. Respondents were 40 students from two seventh classes and one eighth class.

2. In February, 2008 a second questionnaire was given in the same school (Espoo) to the students, where they were asked *which kind of problems they preferred*. In this survey 40 seventh graders from the same three classes responded.

3. In September, 2008 another questionnaire was administered in a school in Helsinki. The data were collected in two 7th grade classes (40 students) within the first month of employment of first author as the teacher in this school. Students were asked to fill in a questionnaire and draw a picture of a topic "Me at a math lesson".

a. In the first class (19 respondents) there was a favourable educational atmosphere and teacher-student relations were built at dialogue level. The atmosphere was promoted by playing Chess, Go, Katamino and other intellectual games. This was a basis for the future introduction of the CheCha method.

b. A comparison group (for the same survey) was a seventh grade class (21 respondents) of another teacher, in which CheCha method was not applied.

RESULTS

1. When responding what can be entertaining in maths, the frequency of choices were humour (55 %), "something else" (27 %), "cutting and drawing" (25 %), "unusual names and properties" (13 %), "plurality of answers" (13 %), and "fabulousness of a plot" (10 %). Altogether 88 % of students mentioned reasons why maths can be entertaining, and 5 % of children had written "nothing" in their specification of what the 'something else' could be.

2. The students' task preferences has shown, that tasks of comic character were most popular (51 %), then were the tasks that could be solved using Lego or Chessboard (33 %), cutting and drawing (30 %), a fantastic plot (15 %) and unusual names and properties (12 %), (Figure 1).

3. a. In this second sample the preferences were slightly different (Figure 1). This time the most popular choice was cutting and drawing (58 %), then the comical character (47 %), the tasks solved with the help Lego and Chess of (26 %), further a fantastic plot (21 %) and unusual names and properties (11 %).

The results of this survey have shown that 74 % of the respondents mention reasons why mathematics can be entertaining. Half of the students mention chess, and 29 % the personality of the teacher as the defining factor.

In the drawing task, 63 % have drawn a joyful image of a math lesson, 11 % of respondents drew themselves thinking or pondering, 15 % represented subjects of maths presented in a positive light (e.g. a notebook with the tasks solved correctly).

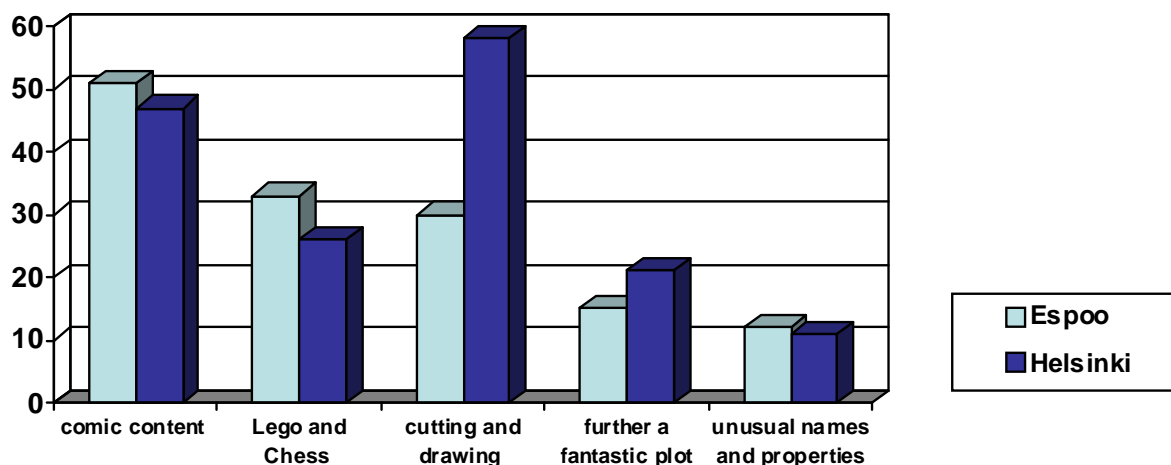


Figure 1. Students' responses to which types of tasks they prefer

When asked to continue the sentence "The CheCha-maths is ..." the most frequent answers were "Great!" (21 %) and "fun" (21 %). 16 % of students noted that it is simultaneously a game and study. There were also individual answers of such a character as "creative and interesting", "many-sided", "various" and "laughter".

3. b. The other survey in the class where CheCha maths was not applied produced somewhat different responses. For the question "It is possible to take pleasure at math lessons" only 26 % gave a positive answer, mostly responding utility of maths, instead any reference to its enjoyable nature. Also the drawing test did not show joyful atmosphere at a lesson. The priorities chosen by these respondents were cutting and drawing (67 %), the comical character (43 %), a fantastic plot (33 %), unusual names and properties (24 %) and the tasks solved with the help Lego and chessboard (10 %). On the offer to make definition "The entertaining maths is ..." the most frequent response was that such maths "is impossible" (29 %). Then was "drawing" (24 %) and there was a fair amount (29 %) of other positive characterisations (e.g. "games", "humour", "of a funny nature", "easy").

CONCLUSIONS

One growing branch in mass media is 'edutainment' where EDUcational purposes are combined with enterTAINING qualities and interaction possibilities (e.g. computer games). Could math education learn something from the edutainment business in order to deepen the students' engagement with maths? We strongly believe that it is

possible to develop suitable (open and multilevel) math tasks with attractive humorous flavouring, that make learning of maths very close to matter of laughter.

When this method was tried out and developed in different schools, the students' feedback points out how the teacher can use humour to engage students with maths:

1. From the students' point of view, entertaining tasks associated largely with humorous content. The longer students are working with humorous tasks, the higher percentage of students prefers such problems over other types of problems.

2. CheCha math method influences the atmosphere in the lesson. The use of intellectual games (or creating a favourable atmosphere in other ways) prepares the ground for the use of humour in the lesson. In an unfavourable atmosphere, comical assignments can lead to undesirable results. The importance of the overall receptive atmosphere was observed in fall 2008. In one of the 7th grade classes taught a part of students responded negatively to use of comic tasks, speaking about "irrelevance" of jokes. When math problems were not understood, the comic presentation of problems caused negative reaction in a part of children. However, tasks with fantasy characteristics did not cause negative reaction. Students were distracted into conversations among themselves, and they moaned about the inconvenient arrangement in a class (the uncomfortably big group was placed in a computer class, not suitable for math lessons). After a replacement into an ordinary classroom the atmosphere had changed into more positive. Playful statements and problems began to be perceived positively, increasing motivation to learn.

REFERENCES:

- Artigue, M. (1994). Didactical engineering as a framework for the conception of teaching products. In R. Biehler, R. W. Scholz, R. Strässer & B. Winkelmann (Eds.) *Didactics of Mathematics as a Scientific Discipline* (pp. 27-39). Dordrecht: Kluwer.
- Boekaerts, M. (1999), Self-regulated learning: Where we are today. *International Journal of Educational Research* 31, 445–457.
- Carroll, L. (2006). *The Complete Illustrated Lewis Carroll*. Wordsworth Edition.
- Cobb, P., Confrey, J., diSessa, A., Lehrer, R. & Schauble, L. (2003). Design experiments in educational research. *Educational Researcher*, 32 (1), 9–13.
- Damasio, A. R. (1995). *Descartes' error: Emotion, reason, and the human brain*. London: Avon Books.
- Dziemidok, B. (1993). *The Comical: A Philosophical Analysis*. Dordrecht: Kluwer.
- Freud, S. (1991). *Jokes and Their Relation to the Unconscious*. London: Penguin Books.
- Greco, J. (2008). *Fundamente Metodice Ale Utilizarii Umorului În Procesul De Pregătire A Cadrelor Didactice Pentru Predarea Limbii Engleze* [The

- Methodological Fundamentals of Humor Application in the Process of English Teachers' Training] A doctoral thesis in Pedagogy. Universitatea pedagogica de stat "Ion Creanga". Chisinau, Moldova.
- Hannula, M. S. (2006). Affect in Mathematical Thinking and learning. In J. Maaß & W. Schölglmann (Eds.), *New mathematics education research and practice* (pp. 209-232). Rotterdam: Sense.
- Izard C. E. (1991). *The psychology of emotions*. N.Y.: Plenum Press.
- Kant, I. (1952). *The Critique of Judgement*. Oxford: Clarendon Press.
- Lear, E. (2002). *The Complete Verse and Other Nonsense*. N.Y.: Penguin Books.
- LeDoux, J. (1998). *The Emotional Brain*. London: Phoenix/Orion.
- Liljedahl, P. (2005). Sustained engagement: Preservice teachers' experience with a chain of discovery. In M. Bosch (ed.) *Proceedings of the Fourth Congress of the European Society for Research in Mathematics Education. Sant Feliu de Guíxols, Spain – 17 - 21 February 2005* (pp. 225-234). Fundemí IQS – Universitat Ramon Llull
- Linnenbrink, E. & Pintrich, P. (2004). Role of affect in cognitive processing in academic contexts. In D. Dai & R. Sternberg (Eds.) *Motivation, emotion, and cognition; Integrative perspectives on intellectual functioning and development*, 57 – 88. NJ: Lawrence Erlbaum.
- Muñiz, L. (1996). Humour problem in education. *Sotsiologicheskyy issledovaniya* 11, 79 – 84. Moscow, Russia.
- Nohda, N. (2000). Teaching by Open-Approach Method in Japanese Mathematics Classroom. In T. Nakahara & M. Koyama (Eds.), *Proceedings of the PME-24 Conference*, Vol.1, 39 – 53. Hiroshima University (Japan).
- Pehkonen, E. (2008). Problem solving in mathematics education in Finland, p.3, www.unige.ch/math/EnsMath/Rome2008/WG2/Papers/PEHKON.pdf
- Pehkonen, E. (2004). State-of-Art in Problem Solving: Focus on Open Problems. In H. Rehlich & B. Zimmermann (Eds.), *ProMath Jena 2003. Problem Solving in Mathematics Education* (pp. 93-111). Hildesheim: Verlag Franzbecker.
- Schoenfeld, A. (1985). *Mathematical problem solving*. Orlando (FL): Academic Press.
- Stacey, K. (1995). The Challenges of Keeping Open Problem-Solving Open in School Mathematics. *International Reviews on Mathematical Education* 27 (2), 62 – 67.
- Suhomlinsky, V. (1975). *Mudraja vlast kollektiva*. Moskva: Molodaja gvardija.
- Veatch, T. C. (1998). A Theory of Humor. *Humor: International Journal of Humor Research* 11 (2), 161-216.