Adults Learning Mathematics: What We Should Know About Betting and Bookkeeping?

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Abstract

A lot of people risk money with bets on sport events or other events. Bookkeepers that offer such bets earn a lot of money. We are making a proposal (more exactly: a concept for a part of a basic mathematics course) for learning mathematics behind the screen (internet bets are very popular). Learners should organize a "sports event" (more precisely: some kind of simulation of such an event), find several different types of bet offices and offer odds. Other participants (learners) get game money and bet. When the event is over and the results are fixed the learners calculate wins and losses. So they learn how to calculate odds and why bookkeepers earn so much money – if the bookkeepers know enough about mathematics and other things they need to know. By considering discovery-teaching-methods students should recognize the mathematical facts while thinking about bets and odds. Reflecting the results learners learn something important about the real world: It is better to avoid bets!

Key words: betting, bookkeeping, gambling, real world mathematics, modelling, propability.

Starting point: Some facts about gambling, money and risks

The German word "Spiel" (= game and play) is a word that covers miscellaneous denotations. It is possible that this word focuses on children playing as well as activities including sports games, e.g. tennis, strategic games, e.g. chess, card games, poker or games in which fortune or destiny as well as professional knowledge could be responsible for winning or losing money, e.g. gambling. If you are interested in different denotations of that word you should have a look for http://www.spielforschung.at and click 'Publikationen' in the menu.

Our goal in this paper is to concentrate on games where you can win or lose money, especially when you are in a betting situation of a sports event, like betting on the winner of a tennis match or a soccer championship. Someone could ask why it is necessary to tell students such things in classroom. We think that this topic is a very authentic one (see Bewersdorf, 1998 or Büchter & Henn, 2004), so that students have the possibility to discuss a real-life-problem which could be found in their near environment (Burkhardt, 1981; Pollak, 1997; Stillman & Galbraith, 1998). Another important point for us is that students should become critical persons who are able to use mathematics as decision support. So talking about such a topic in education gets an ethical aspect (D'Ambrosio, 1985, 1999; Powell & Frankenstein, 1997). When we did some literature research for this we were very astonished how much money is spent, and in succession earned through such betting games especially in the World Wide Web a lot of money can be spent for such games (Weilguny, 2005)! The official website of the German Centre for Addiction Issues (see http://www.dhs.de/web/datenfakten/gluecksspiel.php) offers interesting information on that. There you can read that in Germany people spent 28.000.000.000 Euro for gambling in 2007. The German government earned 4.250.000.000 Euro by taxes because of those gamblers.

Hence, this might be a hint why a centre for addiction issues is arranged. But looking through the law codes of that country a general law against gambling cannot be found. However reasons to think about a general law against gambling, shall be found, particularly if we take a look at some statistics about gambling. In Germany there are about 220.000 pathologic gamblers! The word ‘pathologic’ is important in this term because gambling is recognised as an illness. The World Health Organisation has defined mental and behavioural disorders (WHO, 2006). For example the category habit and impulse disorders – this category includes certain disorders of behaviour that are not classifiable under other categories. They are characterized by repeated acts that have no clear rational motivation, cannot be controlled, and generally harm the patient's own interests and those of other people. The patient reports that the behaviour is associated with impulses to action. The cause of these disorders is not understood and they are grouped together because of broad descriptive similarities, not because they are known to share any other important features. One of these is pathological gambling – “the disorder consists of frequent, repeated episodes of gambling that dominate the patient's life to the detriment of social, occupational, material, and family values and commitments.”

News about gambling or stories about the topic can be found in the daily newspapers as well as in world literature. In the book ‘The Gambler’ (Dostojevsky, 1866) the author has already described compulsive gaming very accurate and precisely by telling a story about the burlesque milieu. In announcements of online-news services and even online-newspapers reports like the following (Chapman, 2006) can be found very often (and easily): “An online gambler has pleaded guilty to stealing more than £1m from his employer to feed an "out-of-control" gambling habit...”

Why is gambling a theme for teaching mathematics?

As a first summary you could say that it is a very problematic situation for many adults to be called a “pathologic gambler”, including high risks for those who gamble and their families and the society. But why should it be discussed in a classroom while teaching mathematics?

A first background for an answer can be found in the Transformational Learning Theory originally developed by Mezirow (1991) which is described by the author as being “constructivist, an orientation which holds that the way learners interpret and reinterpret their sense experience is, central to making meaning and hence learning” (Mezirow, 1994, 222). This theory consists of two basic kinds of learning: *instrumental* and *communicative learning*. While it is possible to focus on learning through “task-oriented problem solving and determination of cause and effect relationships” (Taylor, 1998, 5) within instrumental learning individuals involve their feelings, needs and desires when they are communicative learning. Perspectives and schemes, i.e. meaning structures, are major components of the theory.

The meaning perspectives are defined as “broad sets of predispositions resulting from psychocultural assumptions which determine the horizons of our expectations” (Mezirow, 1994, 223) and are divided into 3 sets of – sociolinguistic, psychological and epistemic – codes. Mezirow (1994, 223) states the meaning scheme as “the constellation of concept, belief, judgment, and feelings which shapes a particular interpretation”. Those structures are understood and developed through reflection. Mezirow (1994, 223) states that “reflection involves a critique of assumptions to determine whether the belief, often acquired through cultural assimilation in childhood, remains functional for us as adults”.

Through reflection we are able to understand ourselves and our learning better, especially if we take care of four proposed ways of learning, which are “refining or elaborating our meaning schemes, learning new meaning schemes, transforming meaning schemes, and transforming meaning perspectives” (Mezirow, 1994, 224).

By taking this theory into account the simple part of the answer is that bets/odds and quotas and wins or losses can be calculated (see Siller, Maaß, 2009). It is relatively easy to understand this calculation with basic mathematical knowledge – the four fundamental operations and easy stochastic needs to be used. If you want to understand the mathematical background of the daily work of a bookkeeper better discussing this topic opens the view to various statistical models. The difficult part of the answer is one of the general aims in education. Maybe the most important aim is going back on Kant (1784) and called “Enlightenment” which can be found in his essay "Answering the Question: What is Enlightenment?”. In modern words, including a little shift of meaning, the general aim of teaching mathematics should enable students to become critical citizens. They should be able to use their mathematical knowledge for analyzing situations, finding rational solutions for problems and to see structures and influences of different factors.

By proposing this topic to students we want to show a good example for the usefulness of real-life-mathematics to understand what happens, when thinking about certain models. Another approach is that students should learn for their life – especially by discussing betting games, not to risk their money and happiness by gambling. This more general aim leads us to a remark a suitable method for lessons or part of a course.

Proposed method of teaching: self exploring and project oriented

Looking at educational activities with the aim that students or other people should avoid risks (e.g. see http://www.afhjournal.org/) – caused by drugs, smoking, or consuming alcoholic drinks etc. (bm:ukk, 1997) – we know that changing behaviour in many cases (Margraf, 2000 or Reinecker, 1999) is not (only) the result of enlightenment or information. Smokers do not stop smoking because they are told that they risk cancer. Many adults tell all the children that they should be careful if they cross a road – but every year children die when they cross roads.

Being aware of those facts it is necessary to include requirement that learning should be based around student's questions. This is the core of inquiry-based learning and inquiry based science. The antecedents of this learning theory can be found in the work of Vygotsky (1962), Piaget (1970), Freire (1984) and Dewey (1997) among others.

In Dewey’s learning theory (optimal) learning and human development and growth occur when people are confronted with substantive, real problems to solve. The curriculum and instruction should be based on integrated, community-based tasks and activities that engage learners in forms of pragmatic social action that have real value in the world.

The focus on the teacher as expert is central to the learning theory of Vygotsky. He proposes cognitive development as the product of social and cultural interaction around the development and usage of tools of cognitive, linguistic or physical nature. The teachers are acting as mentors – they initiate and lead students into the use of technologies, which is called scaffolding (McKenzie, 1997). The work is structured around projects that demand students' engagement in the solution of a community-, school-based and/or regional problem of significance, especially of relevance to the students' worlds.

In Freires assumption the most authentic and powerful pedagogy focuses on the identification, analysis and resolution of immediate problems in the learners' worlds. Therefore, he refers problem-posing. Within this learning theory we find the importance of the argument for demonstrable relevance to the students' world. They should be enabled to analyse, theorise and intellectually engage in their worlds.

If people find their own way to get information, to analyze situations and structure them, to draw conclusions for the behaviour the chance that they really change it will be much better (see Siller, Maaß, 2010). So it seems to be a very good idea to use a self directed method for this theme. Learners should explore the situation and find out their own way to handle it. They develop suggestions for solutions of this topic as a project. So they have the chance to simulate a real betting situation and, by preparing it, they have to think about the mathematical facts of the situation. The students have to think about two different situations at the same time. On the one hand they have to think about a critical discussion about the possible betting attitude of the involved gamblers – which could be all classmates when simulating the situation, on the other hand they have to think about attitudes and possible situations a betting agency could think of.

Proposed course concept

The first step of a learning project should be an agreement of teacher(s) and learners about the theme and the draft of the structure. We think it seems to be a good idea that the teacher (or a student) starts with a proposal and some motivation. This could be a headline from the newsletter like the one we cited at the beginning or a little story like this one: "Last week I have lost some money because I thought that my favourite soccer team will win the cup. I bet for them but they have lost the match and I have lost all my money!"

In every case the draft for finding a structure for this project should include

- some research (or exploration or collecting information) about betting, bookkeepers and rules,
- a simulation of a sports event and betting with game money as main content,
- a documentation of the data of the simulation that will be analyzed,
- common project planning, organizing and responsibility for success,
- common reflections about the results/outcomes.

The second step is the common planning and organising of the learning process. This is the main aim of a group but we do not want to plan the complete project for a group here. Therefore we give some hints about important aspects which the project should include in every case. Starting the research about betting means to list (a lot of) questions:

- What do we want to know?
- Where do we find information?
- Who is going to look here and there?
- What is a good time when the first look should be finished and presented to the others?
- etc.

As a first hint we want to indicate if the group does not really know what they are looking for at the beginning they will formulate very open questions. Maybe they get a flood of information which can be found in the WWW. But this is not a worst case scenario. In contrast – this is desired, because experimental learning can take place. A very good set for inquiry-based learning is created.

Reflecting their experience the group should learn something. It is a very good idea to start any type of research with concrete questions and clear aims. This will make it easier to sort out a lot of information which is maybe very interesting in other situations but not now – for this project. So the second attempt to find out useful information will be more guided by the aims of the work and therefore it will be more successful.

Our second hint is a proposal for a simulation of a sports event. This should be a very simple match for two persons and is realized quick and easy. We made good experience with kicking something small into a kind of goal, which could be the space between two books on a table. Hitting this goal is a kind of training – if you are concentrated and a little bit of skill is trained with your fingers it seems easy to hit it. Therefore, if there are too many hits just narrow the goal for one or two (deci-)meters until just a few of ten trials are hits.

Maybe some students will ask "Why do we need a simulation?" Why don't we take a coin or dices to get something like match results?" This is a very good question that leads to a very important point in this project:

Bets are based on estimations or expectations about the result. People have different reasons to estimate or expect that team A or team B will win – and bet following their estimations and emotions. If the "match" is a random event decided by a coin it is easy and boring to estimate what will happen. The chance is 50% that one of the sides of the coin will win. Therefore it is rational that the bets are distributed equal. No favourite and no outsider will exist.

In our opinion it is necessary that students answer such (a) question(s) on their own. After some research and some practice with being a bookkeeper in the classroom-experiment they will be able to answer such questions themselves.

A third hint is about the documentation of the data. Students like to play a game or to do a simulation but they are not very happy with doing documentation (see Harris, 2004 or Krapp & Weidenmann, 2001). At this point two possible ways exist: One way is to leave the documentation-question open. That means that students will make the experience that they have difficulties to reflect the results of the simulation if they do not remember the results. So they need a second attempt to make it better. The other way is that teachers argue before the experiment starts and convinces the students to document what happens. Maybe the use of a computer with a spread sheet is a good argument to support the documentation and the analyzing of the results.

Many teachers believe that students are not able to plan their learning process well. The paradox in this situation is that the teachers are right as long as they believe it and do the planning without students. If students never have the chance to do the planning or something similar they will never learn it. But if the teacher is convinced that students will be able to plan learning process on their own students will be able to do it. Maybe some teachers say "this is not mathematics" – but this is completely wrong because project planning includes a lot of mathematics. In our opinion it is even applied mathematics.

Some certain aspects of project planning should be mentioned, so that the organisation works better. Here is a short list of it, which a teacher should think about:

- Organisation of the simulation of the sports event: Participants, rules, plan for the matches (like tennis or like soccer?), preparing useful computer support for the documentation.
- Rules for the classroom bookkeepers and also the betting with game money.

- Ethical aspects: What is allowed?

The third step is preparing the next steps. Here we will concentrate on the point of mathematical aspects of bets. How can they be calculated? Let us start with a simple example, a tennis match and a calculation after all bets are done. Let us assume that 60% of the money is bet on player A and 40 % on B. What is the next calculation? The question is: How much money gets a winner? To calculate this amount the quota (or dividend) is defined by a simple division: 100/(Percentage of winning the game), that means in our example:

100/60 = 1.66 is the quota for A and 100/40 = 2.5 is the quota for B.

This means that a winner gets 166 units of money for a 100 unit bet on A and 250 units of money for a 100 unit bet on B. If you bet on A and B wins you lose your money.

Is this calculation realistic? If students ask this, return a question like the following: Do you think so? What does the bookkeeper earn? The first answer might be that bookkeepers have a lot of information about sports events and therefore they win the most of their bets. This is a good idea but a bookkeeper likes to live more comfortably. There is a better source of income for him! Let us look in the internet and recalculate some quotas. We start with an example in Austria which we found (Bet Rapid vs. Sturm, n.d.) but you could also take similar values for other soccer-clubs: a bookkeeper offered following quotas for the soccer match Rapid Wien vs. Sturm Graz: *1.47 : 3.95 : 5.95.*

What he offered in words is to pay 1.47 units for one paid unit if Rapid Wien wins, 3.95 for one paid unit if the result is draw and 5.95 for one if Sturm Graz wins. Now we go backwards, that means dividing 1 by the values of the quotas and adding up these three values:

1/1.47 = 0.68
1/3.95 = 0.25
1/5.95 = 0.16
0.68 + 0.25 + 0.16 = 1.09
1.09, what has happened here!? The result should be 1, not 1.09.

We calculate again and divide 1 : 1.09 = 0.9174. How can we interpret this value?
This value, 91.74 %, means that 91.74% of the whole money the bookkeeper got is paid back to the gambler; 8.36 % is the commission the bookkeeper takes. It is easy to see, that the bookkeeper earns some percentages of the money as commission! If you recalculate more bets and offered quotas you will find 5 to 10 percent commission in most of the cases.

This commission can be found if you search for websites that give information for betting people, e.g. http://www.mr-bet.net. Many websites also compare quotas. In some countries like Austria there is a law, in particular nine different laws for each state (e.g. LGBl, 1995), that fixes the commission to “not more than 10%”.

Several new questions arise now and some others are still open. Our next step is to reflect the first simple example. What can happen if we recalculate it including commission? 100% of the money is paid for bets, 60% for A and 40% for B as winner. The bookkeeper takes his commission – let us say 10%. 90% of the money is left and the bookkeeper’s offer is calculated as shown now: I will give 90% of all the money to those who bet on the win of A if A wins, and I will give 90% of all the money to those who bet on the win of B if B wins. My quotas are: 1.66 · 0.9 = 1.50 (for A) and 2.5 · 0.9 = 2.25 (for B). Is this calculated correctly? Let us try and control! If A wins 60% · 1.50 = 90% are paid. If B wins 40% · 2.25 = 90% are paid. All right!

So we can state that the calculation seems to be correct but the method seems to be not very realistic. A bookkeeper offers bets with quotas some days or weeks before the event happens. He is not waiting until it is over. Yes! This is what makes the life of a bookkeeper exciting or thrilling. In reality we have two different types of bookkeepers. One is really offering fair bets that are calculated after all bets are ready. This one is the so called "totalizator". This type of bookkeeper is very rare – in Austria and Europe – but still exists – in other countries like Australia it is the only off-course legal form. Although this type of bookkeeper has not so many (or very few) customers his life is not that thrilling because the commission is independent from the result of the match. Again: Whoever wins the match and however the bets are situated the commission is earned. Gamblers do not like such totalizators because they do not make mistakes with quotas and you cannot really gamble with those quotas.

The type of bookkeeper which can be found in the internet has to start with a certain offer, which means he has to think about a starting quota. If a bet is accepted this bookkeeper has to pay the winner the offered quota – even if the first quota is changed after a while. This opens the door to a lot of statistical calculations: What would happen if...? We will come back to that point later. The important point here is that students will learn a lot about calculating quotas if they start to offer them when they play the role of a bookkeeper in the classroom.

Step number four is the first trial of betting – a very small simulation! We think it is a good idea to start with a simple match within the project group: Two students train for a kicking simulation, other students play bookkeeper and offer quotas. Let us imagine that A and B train to hit the goal and A is more successful: A has 6 hits of 10 trials and B 3 of 10. Now the bookkeeping students (organized in groups of two or three persons) should offer first quotas. What should they offer?

Different solutions are possible. Is it a good idea to take the training results as if they would be probabilities? There is a chance of 6 : 3 that A will win? This is not correct from a mathematical point of view because probability-values have to be 1 or less. Our next trial, is just a better formulation: 6 : 3 can be translated as A will win 2 of 3 games. This is a probability of 2/3 or 66.67%. The quota is calculated as explained above as reciprocal, $1 : 2/3 = 3/2 = 1.5$. This might be realistic. The quota for B is $1 : 1/3 = 3$ in this case. Controlling the quotas we find that $2/3 + 1/3 = 1$ – that is right but the commission is not included yet. If the student bookkeeper likes to get 10% commission they should offer these quotas: $1.5 \cdot 0.9 = 1.35$ for A and $3 \cdot 0.9 = 2.7$ for B. After that the student-bookkeepers hope that the other students make their bets as estimated – 2 of 3 bet on A and 1 of 3 bet on B.

Other student bookkeepers might think in other directions – as we are mentioning now: A is much better than B. Therefore all people will bet on A – of course. What is a good quota for this situation? If A wins with a probability of 1 the quota for A is $1 : 1 = 1$. In this case the quota for B as winner must be 1 : 0 = ??? (an infinity high quota?). Both quotas (for A and B) will cause problems: If the quota for A is 1 and the bookkeeper likes to get "his" 10% commission he will pay a winner 90 percent of his money back. What is the reaction of the winner? If against all estimations B wins a gambler who has made a bet on B will get an infinity amount of money – that is impossible.

The bookkeeper cannot promise to pay the winner more than all money on world. So the bookkeeper has to offer a very high quota, for example 100. If you look into the WWW, you cannot find such high quotas. Is a bookkeeper thinking in such a direction he has to look for practical limits and will see that the lowest quota which can be offered is at least 1.1 or something like that for A. As a consequence the quota offered for B should not be higher than 20 or 30. The student bookkeepers must hope that other students make their bets as estimated – according to the offered quotas.

Step five is reflecting the results of the first trial and planning the next steps. After the first experiments it is good to look back and reflect about the situation together (students and teacher). Students that played the bookkeepers have double expectations. A first question could be: What do bookkeepers expect that gamblers will expect? A second question is: Is there any influence of the offered quotes on the gambler? A third question, which is in reality the most important point, could be: How much do the bookkeeper like to earn?

A first or later summary might be that a bookkeeper offers good quotas if he gets his commission without risks (=whoever wins) – that is the role of the totalizator. The offered quotas should be the same as they would be when they are calculated afterwards. The risk of a bookkeeper is growing as more as his quotas differ from those of the totalizator!

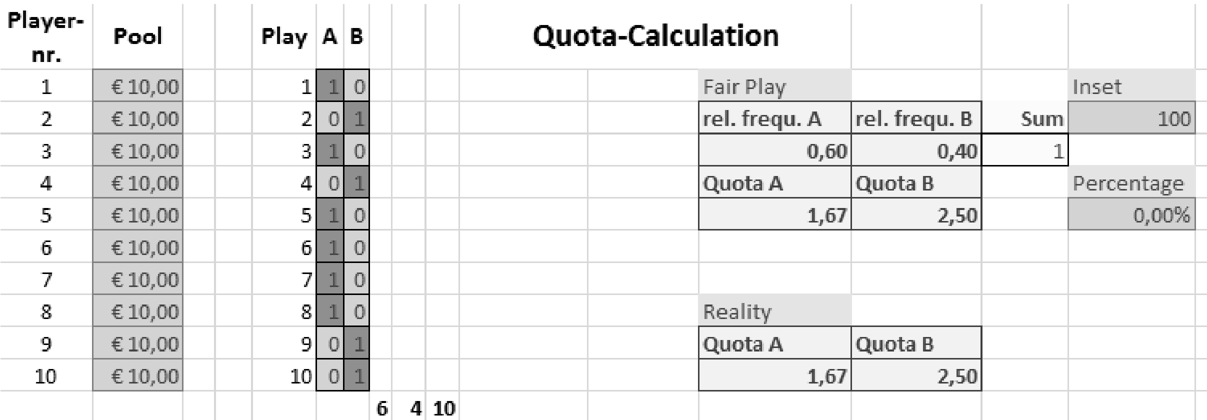
Maybe the students decide to make more trails with better knowledge to get better experience and more documented data. Maybe they like to do more mathematics first. Some possible questions including some mathematical content are:

What happens if the first quota of a bookkeeper is wrong? Wrong means that people bet not as estimated. Let as calculate an example. A bookkeeper offers 1.35 for A and 2.7 for B with the idea that the probability for A winning is 2/3 and the bookkeeper likes to earn 10% commission as explained above. After a while this bookkeeper recognizes that 50% of the incoming bets go to A and 50% to B. What could happen if he does not react and change quotas? If A is the winner he has to pay 1.35 units for each unit of the 50% that have bet on A. In other words: He has to pay 67.5% of the money to those who have bet on A. This will be a very good situation for him – he will earn 32.5% of the money. But if B is the winner, he has to pay 2.7 units to each of the winners, together 135 % of the incoming money. In other words: If B is the winner, the bookkeeper has to pay 35% more then he has earned! He has to give the people who bet on B some (or a lot) from his own money. This is some kind of worst case scenario for him!

The calculation needs more mathematical knowledge if we try to understand what will happen if the bookkeeper changes his quota every day or each time when 1000 units are in. In fact this is much easier if we take a spread sheet and type in the data and the according formula. The results of such an experiment are easy to understand. The bookkeeper has the best chances to earn money by commission if he changes the quota very flexible following the incoming bets.

Using spreadsheets

Now we can think about a simulation which calculates the quotas for a totalizator and a bookmaker. The bookmaker is taking the starting-value of the first simulation, the totalizator is calculating his quota by the incoming bets as explained above. A little simulation could look like the following:



Player-nr.	Pool	Play	A	B			
1	€ 10,00	1	1	0			
2	€ 10,00	2	0	1			
3	€ 10,00	3	1	0			
4	€ 10,00	4	0	1			
5	€ 10,00	5	1	0			
6	€ 10,00	6	1	0			
7	€ 10,00	7	1	0			
8	€ 10,00	8	1	0			
9	€ 10,00	9	0	1			
10	€ 10,00	10	0	1			
					6	4	10

Quota-Calculation

Fair Play			Inset
rel. frequ. A	rel. frequ. B	Sum	100
0,60	0,40	1	
Quota A	Quota B		Percentage
1,67	2,50		0,00%
Reality			
Quota A	Quota B		
1,67	2,50		

Figure 1. Simulation of a sport event using a spreadsheet: totalizator

It is possible to see, that the quotas of the totalizator are very low compared to the starting quota of the bookmaker. Let us have a look at it in the simulation:

Player-nr.	Inset	Play	A	B			
1	€ 10,00	1	1	0			
2	€ 10,00	2	0	1			
3	€ 10,00	3	1	0			
4	€ 10,00	4	0	1			
5	€ 10,00	5	1	0			
6	€ 10,00	6	1	0			
7	€ 10,00	7	1	0			
8	€ 10,00	8	1	0			
9	€ 10,00	9	0	1			
10	€ 10,00	10	0	1			
11	€ 0,00	11	0	0	6	4	10
13	€ 0,00	13	0	0			
14	€ 0,00	14	0	0			
15	€ 0,00	15	0	0			
17	€ 0,00	17	0	0			
18	€ 0,00	18	0	0			
19	€ 0,00	19	0	0			
20	€ 0,00	20	0	0			
21	€ 0,00	21	0	0	6	4	10
22	€ 0,00	22	0	0			
23	€ 0,00	23	0	0			
24	€ 0,00	24	0	0			
25	€ 0,00	25	0	0			
27	€ 0,00	27	0	0			
28	€ 0,00	28	0	0			
31	€ 0,00	31	0	0	6	4	10
32	€ 0,00	32	0	0			
33	€ 0,00	33	0	0			
34	€ 0,00	34	0	0			
35	€ 0,00	35	0	0			
38	€ 0,00	38	0	0			
39	€ 0,00	39	0	0			
40	€ 0,00	40	0	0			
41	€ 0,00	41	0	0	6	4	10
42	€ 0,00	42	0	0			
100	€ 0,00	100	0	0			
101	€ 0,00	101	0	0	6	4	10
102	€ 0,00	102	0	0			
	€ 100,00		6	4	6	4	10
	Sum of bettings:	10					

Bookmaker

	Reality			
found	Quota A	Quota B		Inset (Sum)
	4,44	5		€ 100,00
				Percentage
				10,00 %

Totalizator

fair Play		
rel. frequ. A	rel. frequ. B	1
0,60	0,40	
Quota A	Quota B	
1,67	2,50	
Reality		
Quota A	Quota B	
1,50	2,25	

Totalizator (cumulated)

fair Play		
rel. frequ. A	rel. frequ. B	1
0,60	0,40	
Quota A	Quota B	
1,67	2,50	
Reality		
Quota A	Quota B	
1,50	2,25	

Payout

	A	B
found calculation	€ 266,40	€ 200,00
flexible calculation	€ 90,00	€ 90,00
cumulated calculation	€ 90,00	€ 90,00

Profit bookmaker

	A	B
found	-€ 166,40	-€ 100,00
flexible	€ 10,00	€ 10,00
cumulated	€ 10,00	€ 10,00

Figure 2. Simulation of a sport event using a spreadsheet – comparing quotas and profit

It is possible to recognize that the bookmaker is losing a lot of money because of the fact that the quotas are that high. Therefore it is necessary that the bookmaker is changing the quotas.

Let us try to find some quotas where the bookmaker is winning. After a good deal of thought the bookmaker will recognize that starting quotas should be met around 1.2 to 2. The bookmaker will make some account, as it is shown in the picture:

Player-nr.	Inset	Play	A	B			
1	€ 10,00	1	1	0			
2	€ 10,00	2	0	1			
3	€ 10,00	3	1	0			
4	€ 10,00	4	0	1			
5	€ 10,00	5	1	0			
6	€ 10,00	6	1	0			
7	€ 10,00	7	1	0			
8	€ 10,00	8	1	0			
9	€ 10,00	9	0	1			
10	€ 10,00	10	0	1			
11	€ 0,00	11	0	0	6	4	10
13	€ 0,00	13	0	0			
14	€ 0,00	14	0	0			
15	€ 0,00	15	0	0			
17	€ 0,00	17	0	0			
18	€ 0,00	18	0	0			
19	€ 0,00	19	0	0			
20	€ 0,00	20	0	0			
21	€ 0,00	21	0	0	6	4	10
22	€ 0,00	22	0	0			
23	€ 0,00	23	0	0			
24	€ 0,00	24	0	0			
25	€ 0,00	25	0	0			
27	€ 0,00	27	0	0			
28	€ 0,00	28	0	0			
31	€ 0,00	31	0	0	6	4	10
32	€ 0,00	32	0	0			
33	€ 0,00	33	0	0			
34	€ 0,00	34	0	0			
35	€ 0,00	35	0	0			
38	€ 0,00	38	0	0			
39	€ 0,00	39	0	0			
40	€ 0,00	40	0	0			
41	€ 0,00	41	0	0	6	4	10
42	€ 0,00	42	0	0			
100	€ 0,00	100	0	0			
101	€ 0,00	101	0	0	6	4	10
102	€ 0,00	102	0	0			
	€ 100,00		6	4	6	4	10
		Sum of bettings:					10

Bookmaker

Reality

	Quota A	Quota B
found	1,2	2

Inset (Sum): € 100,00

Percentage: 10,00 %

Totalizator

fair Play

rel. frequ. A	rel. frequ. B	
0,60	0,40	1
Quota A	**Quota B**	
1,67	2,50	

Reality

Quota A	Quota B
1,50	2,25

Totalizator (cumulated)

fair Play

rel. frequ. A	rel. frequ. B	
0,60	0,40	1
Quota A	**Quota B**	
1,67	2,50	

Reality

Quota A	Quota B
1,50	2,25

Payout

	A	B
found calculation	€ 72,00	€ 80,00
flexible calculation	€ 90,00	€ 90,00
cumulated calculation	€ 90,00	€ 90,00

Profit bookmaker

	A	B
found	€ 28,00	€ 20,00
flexible	€ 10,00	€ 10,00
cumulated	€ 10,00	€ 10,00

Figure 3. Simulation of a sport event using a spreadsheet – comparing quotas and profit

After these first considerations about getting quotas, we are able to recognize that betting in the office of a bookmaker is very risky. This betting agency has to bet too, especially for minimizing the risk to lose a lot of money. In contrast operating a betting agency of a totalizator is very relaxing, because you always will win money, depending to the percentage you get.

Another fact which is relevant for a totalizator is in which time the quota should be changed or is it the same the whole game long. This question is very difficult and cannot be answered by us. But if you have a look at gambling sites in the WWW you can see that offered quotas change sometimes. But why is that so? We do not have background information about that, but we think that such bookkeepers want to earn a lot of money and know insider information about the offered game, so they can change the quotas because a certain event could happen. So it is exciting for students to think about such a possibility in the simulation, because they can compare what happens if the quota changes after a single bet which was taken or what changes if the quota changes after a certain amount of bets.

Conclusion

From our point of view it is absolutly necessary that students discuss real life problems in classroom. We know that adults are also more motivated for learning if they find examples from their life in the mathematics course. Looking at our example “Betting in sports” it is obvious that students know more about the calculation of bets. They should have learned why and how a bookkeeper earns money and who gives them money – the gamblers. They learn to organize themselves as learners and last but not least they learn to use mathematics meaningful and expedient mathematics.

Thinking about new ideas for and in mathematics education, it is obvious that existing theories in terms of learning mathematics can be very useful. Real real-life-problems can be discussed with students and even can be taken as interesting classroom problems so that students are able to learn mathematics on their own (see Siller, 2009) and the (suggested) methods are appropriate to acquire mathematical skills for life.

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