

# AGAINST ALL ODDS

●  
Murray Sanders  
and Eric Hamm

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TEACHING MATERIALS  
*from the*  
STEWART RESOURCES CENTRE





# Against All Odds

by  
Murray Sanders and Eric Hamm

CELS 1993  
S105.7

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To meet a need for resources for the new Math 10 curriculum, the Saskatchewan Teachers' Federation in cooperation with Saskatchewan Education Training and Employment, initiated the development of teacher-prepared unit plans.

A group of teachers who had piloted the course in 1992-93 were invited to a two and a half day workshop in August, 1993 at the STF. The teachers worked alone or in pairs to develop a plan for a section of the course.

Jim Beamer, University of Saskatchewan and Lyle Markowski, Saskatchewan Education Training and Employment acted as resource persons for the workshop.



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<b>Subject:</b>	Social Studies
<b>Unit Topic:</b>	Saskatchewan Industries and Resources: Mining, Agriculture, Forestry, Fishing, and Manufacturing
<b>Grade Level:</b>	Four
<b>Ability Level:</b>	All
<b>Time Allotment:</b>	Approximately 20 hours
<b>Teacher:</b>	Gail Yonkman
<b>Teacher-Librarian:</b>	Brenda Brownlee
<b>School:</b>	Punnichy Elementary, Punnichy, SK

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## **Time Allotment**

5 class periods

## **Topic**

Probability

## **Subject**

Math 10

## **Overview**

Students will be very briefly introduced to the concept of probability and then placed into a group learning situation. The group will be asked to present a report that develops a new game of chance to be used with new players. The group will design a game, present charts showing the odds of winning and the probability of the ‘house’\* making money. After the games are tested, the other groups will evaluate the game and discuss its merits. Discussion will then proceed to consider whether a player can actually make money and the impact gambling has on the individual and society in general. The students will learn the math (almost implicitly) while doing some serious thinking about profit/loss and the effects of gambling on society.

\*management of a gambling establishment

## **Rationale**

There are few good opportunities in the math classroom where we can spend time on the Common Essential Learnings skill of Personal and Social Values and Skills. This unit is ideally suited for it by studying the impact of gambling on the individual and on society. While we realize that this unit could be done during one or two class periods we strongly recommend that the extra time be allotted so that some of these outside considerations will be examined. This unit does not advocate gambling but has the students consider its implications. The students learn the math skills on an implicit level, which we believe is very effective in this situation.

Because this unit is often a major change of pace from the regular math classroom, it can be used as a breather between two heavy units. The students appreciate the change of pace and will react quite

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positively (well - most of the time!) to this unit. The discussion over the establishment of the evaluation criteria, the new game, and the discussion of the merits and effects of each game will create lively classrooms and you will need to be ready to “rein them in.”

Good Luck and have fun!

## Objectives

### A. Foundational Objectives

- Appreciate the role of probability in understanding everyday situations
- Communicate a summary of financial projections in appropriate reports, tables, and graphs
- To support students in treating themselves, others, and their environment with respect
- Promote ideas, processes, experiences, and objectives in meaningful math contexts

### B. Outcomes

- List sample space and events in a random experiment
- Calculate experimental probability for simple events
- Calculate the theoretical probability of an event and the probability of its complement.

## Evaluation

Evaluation will be done on an on-going and end-product basis and will be based on 3 categories.

1. participation      10%
2. group quiz      20%
3. report evaluation    70% (35% group evaluated/35% teacher evaluated)

While this will produce a “numerical mark”, evaluation through checklists can evaluate a student’s social skills, work habits, contribution to group, analytical ability, etc. We would recommend that the group as a whole do self-evaluation based on the statement, “The highest mark should go to the group with the highest profit on the most ethical game.” The idea is for groups to consider both issues and then come up with an evaluation system that, democratically, the class can live with!

**Note:** This is only a suggestion. Feel free to use a method you feel comfortable with. This evaluation is used to introduce some of the techniques mentioned in the Evaluation Handbook.

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## **Common Essential Learnings**

This unit actually uses all of the CELs with the possible exception of Technological Literacy. The stress would be on the three CELs of Critical and Creative Thinking, Communications, and specifically Personal and Social Values and Skills. The stress is deliberately on the Personal and Social Values and Skills CEL and we would encourage you to stress this as well.

## **Adaptations**

We have deliberately chosen to leave this unit slightly vague in terms of instructional approaches. It is conducive to group work if you are wishing to try some co-operative learning. We would encourage you to use this concept but to fit it into a style you are comfortable with.

While we have chosen to learn only the basics, students will tend to come up with projects that may involve permutations and combinations. You will have to find a level you are comfortable enough with. If you want a challenge, allow your groups to tinker with the concepts of permutations/combinations. However, we would encourage you to allow students to do some discovery learning or perhaps some individual learning rather than having you teach the units.

## **Resources**

This unit is designed to allow you a wide range of resources. The film “Of Dice and Men” is a good introduction and we do encourage you to borrow it. Most of our probability material comes right out of current texts in our Book Bureau such are: Algebra and Trigonometry: Structure and Method Book 2, Mary P. Dolciani and others, 1982 and Addison-Wesley Mathematics 10, Brendan Kelly and others, 1987. Other useful resources are: MECC–Probability Kit–; F.Y.I. For Your Imagination, Instructional Strategies Series, Saskatchewan Professional Development Unit and Saskatchewan Instructional Development and Research Unit; Teaching Statistics and Probability, National Council of Teachers of Mathematics, 1981; Exploring Probability by Newman, Obremski, and Scharfer (Seymour Publications ISBN: 0-86651-333-7 c1987). You may also want to line up some dice (you can use dice with any number of faces you wish), coins, cards, thumb tacks, spinners, etc. for students to explore with.

## **Assessment Techniques**

There is a lot of room for flexibility here but this is a possible option for you to use.

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## Teacher Assessment

### 1. The Quiz on day 4

It is designed to ensure that the essential math skills be checked. We are encouraging group dynamics by having the group be responsible for ensuring that all students know and can show how to do each of the questions. The individual student in the group will be responsible for only 1 or 2 questions but the group score will be a compilation of all students' scores. Quiz might be worth 20% (don't be afraid to change these values.)

### 2. The end report

Report is designed to show students' thought processes in trying to sell you their game. Our evaluation would concentrate on the areas of:

- (a) Did the game meet the initial criteria?
- (b) Did the report clearly show and explain how the odds were calculated?
- (c) Did the group explain their balancing of the concepts of ethical vs profit?
- (d) The overall organization and presentation of the report should be well thought out and organized.

Report might be worth 70% or so.

### 3. Performance Assessment

While we wanted to come up with a numerical grade, we wanted to try some checklists as well. The 3 checklists we chose to use are found on page 84-86 of the Student Evaluation Handbook. We would encourage you to revise these to fit your own areas of importance. They are good for creating anecdotal records to keep in a student's file.

## Group Evaluation

### 1. Other Groups' Games

It is important that the criteria be laid out clearly before the evaluation begins. We specifically wanted students to go through the process of developing a group evaluation but the teacher will need to carefully monitor the results so that the instrument works. We would encourage a system that is quite simple. For example:

Amount of Profit	Ethics	Enjoyment of Game	Overall
—/10	—/10	—/10	—/10

From this the groups should be able to defend each ranking including reasoning for giving their "number."

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## 2. Self-evaluation

Have students evaluate each other's performance within the group by using a scale such as the one on page 85 of the Student Evaluation Handbook, but we recommend they also give a number out of 10 to show how they feel about an individual's overall contribution to the group. You can make it clear that you will use this mark as part of your final numerical evaluation.

## Hour #1 Suggested Activities

- A. Introduce the concept of probability by having students brainstorm for possible areas where probability might be used or observed. The use of dice, spinners, thumbtacks works well as introduction. Eg. Surveys, lotteries, games, genetics. *10 minutes*
- B. Introduce the 10 minute film "Of Dice and Men" (National Film Board) and show it. *12-15 minutes*
- C. Debrief the film to extract the terms
- (a) probability )
  - (b) simple event ) Record these
  - (c) sample space )
  - (d) experimental probability )
  - (e) theoretical probability )
- 10 minutes
- D. Discuss gambling, lotteries, games of chance, etc.



### Teacher Tip #1

Note: Introduce the notion of (a) "fairness of the game," (b) "addition to the game," (c) who are the players? *10 minutes*

- E. Focused Imaging (Have students close their eyes and imagine as you speak) *5 minutes*.

For teacher background see: F.Y.I. For Your Imagination.

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### **Hypothetical Situation:**

Imagine yourself living as part of a community in the north. The area is forested and the ground is rocky (Precambrian shield area). People here grow up, have babies, play hockey, shop for groceries, and work for a living like anywhere else except that here, the copper mine is the main employer. Many people here enjoy outdoor recreation but they also like to gamble . . . many folks play “Bingo” for fun. You are the owner of the “Bingo Palladium” and today you’ve decided to introduce a brand new game to some of your patrons.

Unfortunately the game hasn’t been invented yet and you must invent it with the help of your staff. The criteria/rules of the game are to be:

- (1) It is intended to serve novices to gaming; it must be simple!
- (2) It should be fun to play and make the player want to come back.
- (3) It should have a fair chance of being won at any time. No ties permitted.
- (4) It should (on the long term) make money for the Bingo Palladium.
- (5) Evaluation will be based on the statement: Most Profit, Most Fun, Best Ethics.

Tomorrow you will meet with your staff and come to a decision.

## **Hour #2 - Suggested Activities**

- A. Perhaps try a little handout/chalkboard example, concept attainment activity, or direct teaching to familiarize the students with the simple math inherent in the probability of an event.



### **Teacher Tip #2**

Note: This is a good place to try an alternate teaching style such as concept formation by showing students examples that work and examples that did not and having them guess how the desired event was calculated. *15-25 minutes*

(Example) Rolling a die to get a 6.

Simple events are 1, 2, 3, 4, 5, 6

Sample space is (1, 2, 3, 4, 5, 6)

Desired event is (6)

Probability of rolling 6 is:  $\text{Desired Event} = 1/6$

Sample Space

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Make sure students know:

- (a) simple event
- (b) sample space
- (c)  $P(\bar{E})$  (Probability of an event)
- (d) Experimental Probability
- (ie)  $\frac{\text{actual}}{\text{attempted}} = P(\text{Experimental Event})$

One could try a few experiments here with dice, cards, or spinners.

B. Group the students into groups of 5 or so.

- Have groups elect a leader and a recorder.
- Arrange papers and pencils, etc...functional arrangements.
- These groups will become the “Bingo Palladium” owners and their staffs.
- Distribute a paper copy of the focused imaging scenario from day 1 as well as the rules of engagement (see Hour #4 page 9).
- Review the situation briefly and allow the students the balance of the period to discuss, invent, and “write out” the description of their game.



### **Teacher Tip #3**

Note: Students will need a fairly clear set of instructions on what the game write-up might entail. Because these are suggested activities you may want to “tailor make” required outcomes. Here are a few you could try:

Write a game report that includes:

- (1) A description of the game - be detailed - use examples.
- (2) The sample space of all possible simple events . List these if possible.
- (3) The probability of at least 5 selected outcomes that would happen playing your game.
- (4) A financial plan
  - What does it cost individuals to play it once.
  - How much can a player win on any one play...examples
  - Predict what the “Bingo Palladium” can expect to make if 1000 people play the game once each. (or otherwise project profits and validate the amount)
  - If your game or the playing of it depends upon factors or events out of the Palladium’s control.

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(5) Estimate by writing down what you think will be the effect on a customer...will he/she want to play again?

(6) This project write-up is due in Hour #4 (game day) and will count in your evaluation.

C. Allow the balance of the period for group discussions and planning.

#### **Teacher Tip #4**

Note: You may need to provide practice materials so it is a good idea to have an assortment available (eg) cards, dice, spinners, multifaceted die ( $>6$ ), etc...

Note: Also that on game day the “Bingo Palladium” will provide all necessary materials; that is, the student groups themselves arrange and prepare for this.

### **Hour #3 - Getting Ready**

A. Today’s objectives include reinforcing the underlying mathematics inherent in basic probability problems. In addition we want to allow additional planning time to prepare “the game.”

Arrange the seating into the groups as before and provide each with blank paper, pencils, etc. Once settled, briefly review (a) simple events, (b) sample space (c)  $P(\text{Event})$  (d) Experimental probability and introduce the probability of the complement of an event;  $P(\bar{E})$ . One can quickly relate this to winning a coin toss or losing it and at the same time explore the total range of probabilities from 0 to 1 (i.e. impossibility and certainty). *25-45 minutes*

\*\*\* The teacher needs to have previously prepared 10 questions on probability that reflect the concepts to be learned. These should be typed and copied, ready for distribution.

Note: See Dolciani “Modern Algebra Book 2”, page 600-603 as an example.

#### **Instruction:**

Each person in the “Bingo Palladium” (group of 5) must now learn to do the 10 questions just distributed. The groups themselves may decide how this gets done. Evaluation of their learning will amount to the teacher randomly selecting students and posing any two of the questions to the selected student(s). Note the mark awarded to the group will be the mark awarded to the individual(s) on this skill.

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- B. The balance of time remaining in this period is devoted to refining the “game” in the groups. The individual teacher may decide how to conduct the question evaluation above. This can be done prior to or concurrently with the group work.
- C. Near the end of this period, remind your students
- (1) Projects and write ups are due tomorrow (next day)
  - (2) Materials for game day are student responsibilities
  - (3) Bingo/Poker chips or monopoly money for the players will be provided by the teacher.

## **Hour #4**

**Objective:** Evaluate each of the games presented

Rules of Engagement:

1. Set up your group’s game on a table somewhere in the room.
2. Designate 2 players to work first half of period, 2 players for the second half.
3. Rest of players in group become players.
4. Group receives \$10,000 in play money or chips in denominations of \$50, \$100, \$500.
5. Top wager is \$500.
6. Each player carries a piece of paper for each of the other group’s games. On it he/she records the amount wagered on each bet, the win or loss, and how much lost (if any).
7. The playing lasts 20 minutes.
8. You may set a maximum limit as to how many players can participate each time.  
  
Option: If time allows and you can line up some prizes (pop, chocolate bars, etc.), have an auction and let groups bid for them. Adds a little “incentive” to the day.
9. At end total your group’s wins/losses for each game. Send each group your stats on their game.
10. If time allows, discuss your feelings about each of the games, including your own. Were they ethical? Were they money makers?

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## Hour #5 - Judgement Day

**Objective:** Today we will explore a variety of traditional and other evaluation methods. We will end up with a mark/number or letter.

A. Rearrange your students into the groups and, as before, assure that they have pen, paper, etc.

\*\*\*\*\* The record of winnings, losses, and profits must be available to today's groups. You may even want to duplicate these results for each group. Calculators will be handy as will a white or chalk board.

B. Teacher writes on the board: (judgement criteria)

Which are: "Most Profit, Most Fun, Best Ethics"

Now we initiate a group process which seeks to evaluate the results. This may be a bit chaotic and may not produce definitive results.

### **Suggestions:**

1. Obtain an exact tally of each student's winnings or losses (Post this).
2. Obtain an exact tally of each group's winnings or losses (Post this).
3. Make a checklist of value judgements on the "play worthiness" of games in general. Circulate the checklist (one for each game) (Post the results).
4. Initiate a class discussion which addresses ethics of the gambling event:
  - (a) Degree of profit making
  - (b) Moral tone of gaming/gambling
  - (c) Gambling as a tax on the poor
5. Review the mathematical foundation of each game (time permitting)

That is: Probability of winning ) could tie in to  
Probability of not winning (the house wins) ) complement  
Percentages - wins/losses

6. Circulate a page where each student writes his/her name followed by a ranking of groups

Ex. Joe Smith: 2, 5, 1, 3, 4 (first to last)

...the class can then do a totalling exercise such as:

first - 5 points )  
second - 4 points ) The totals create an overall  
third - 3 points ) ranking  
fourth - 2 points )  
fifth - 1 point )

Note: This is a suggested evaluation only. Individuals may, and likely will, choose to modify the process.