|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Video Title | **Conditional Probability... and Magic!** | | | |
| Topic | Mathematical Thinking | | | |
| Aim(s) | What you know about a problem guides you towards the correct solution: conditional probability tells you why. But there is more: let’s discover together how the same concept can be applied to less intuitive – and somewhat magical - contexts. | | | |
| Length | 45min | | | |
| Camp Location | (Leave BLANK for the facilitators that will use it) | | | |
| Facilitators | (Leave BLANK for the facilitators that will use it) | | | |
| N. of students | (Leave BLANK for the facilitators that will use it) | | | |
| Date | (Leave BLANK for the facilitators that will use it) | | | |
| Resources  needed | Per group of learners: deck of cards, 2-3 blank paper sheets, and a pen. A board would be helpful. | | | |
| Preparations | The learners will be divided in groups of two. If their number is odd, there will be one group of three learners | | | |
|  | | | |  |
| **Video time** | **What facilitator does** | **What learners do** | | **Comments** |
| 00:00 - 00:26 | General VMC Video Introduction | | | |
| 00:27 - 00:37 | Video Introduction | | | |
| 00:38 - 01:06 | Material | | Instead of coloring the four cars yourself, you can take two black and two red cards from a deck | |
| 01:07 - 02:14 | General explanation of conditional probability | | | |
| 02:15 - 02:42 | Introduction of the first experiment – Part 1 | | | |
| VIDEO PAUSE Experiment: Guess who the Facilitator is thinking about | * If the learners do not know each others well yet, make them stand up and tell their names, and write them on the board. Leave some blank space at the side of each name: it will be used to draw the crosses (see “Conclusion of the first experiment and discussion”). Use this time to choose a learner in your head. * Write the name of the chosen learner on a sheet of paper and without any hint ask each group to guess | * After their names have been written on the board, each group will choose the learner they think the facilitator is thinking about and write it on their sheet of paper. | |  |
| 02:43 - 3:21 | Introduction of the first experiment – Part 2 | | | |
| VIDEO PAUSE Experiment: Guess who the Facilitator is thinking about (with 3 hints) | * Give the classroom three generic hints about the learner you chose. Hints should not be too specific: choose some characteristics that are shared among the learners (i.e. tall/short, male/female, light shirt/dark shirt, etc) | * After having received the three hints, each group will try to guess again and again write their guess on the sheet of paper. | |  |
| 3:22 - 3:52 | Conclusion of the first experiment and discussion | | | |
| VIDEO PAUSE Discussion: Guess who the Facilitator is thinking about | * After each group has made its guess, collect first the “uneducated” guesses (without hints) by adding a cross close to the corresponding name for each guess. The resulting distribution should be random. * Then, collect the “educated” guesses (after the hints) by adding a circle close to the corresponding name for each guess. This time, there should be more right guesses. * Promote discussion about why this happens: were they sure about their guess the first time? Were they sure the second time? The second time, could they tell for sure someone was not the right guess? | * Share ideas and discuss! | | The goal here is not to explain exactly why, but simply thinking about it. |
| 3:53 - 5:01 | Solution of second experiment and invitation to discussion | | | |
| 5:02 - 8:42 | Introduction of the second experiment | | | |
| VIDEO PAUSE Experiment: Guess where the red card is... and then guess again | * Make sure everybody understands how the game is carried out and help the groups who get confused. | * The “guesser” covers his/her eyes and the “dealer” shuffles the three cards and disposes them on the table. He/she has to make sure to remember where the red card is! * The “guesser” uncovers his/her eyes and guesses. * The “dealer” uncovers one of the two cards the “guesser” hasn’t chosen. The uncovered card must always be one of the two non-red cards! (Since there are two non-red cards, there will always be at least one non-red card the guesser hasn’t chosen) * The “guesser” chooses whether to change his/her guess or not * The “dealer” reveals the red card and tells the “guesser” if he/she has guessed right. * In the 2-by-2 table, annotate the outcome with a cross in the corresponding case (changed / didn’t change mind; right/wrong final guess) * Repeat this game 10 times, then swap roles and repeat other 10 times | |  |
| 8:43 - 9:17 | Conclusion of the second experiment and invitation to discussion | | | |
| VIDEO PAUSE Discussion: Guess where the red card is... and then guess again | * Collect the results and observe the two distribution: make the learners comment the outcome * Facilitate the discussion: the “dealer” never told anything about the winning card, and nonetheless the “guesser” guessed right more times after the hint than before. Why? How can this be viewed in terms of the first experiment? * You can also go deeper and show the math behind this: the first guess is a random one: the “guesser” has 1/3 probability of choosing the red card. If the “dealer” only told the “guesser” to choose a different card, there would be two situations: 1) if the right card was chosen (prob. 1/3), the probability of choosing the right card would be 0 2) if the wrong card was chosen (prob 2/3), the probability of choosing the right one would be 1/2. Hence 1/3\*0 + 2/3\*1/2 = 1/3, the probability has not changed. * But if the “dealer” removes one of the two wrong cards before letting the “guesser” choose again, the outcome changes: in 1) we have 1/2\*0, and in 2) we have 1/2\*1; thus 1/2\*0 + 1/2\*1 = 1/2. So if the “guesser” changes his/her guess, he/she will have 1/2 probability of getting it right, against the initial 1/3 probability! The winning strategy is thus to always change your card after the first guess. | * Share your ideas about the ability of the “guesser” to guess the right card before and after the “dealer” gave the hint | | The goal here is not to explain exactly why, but simply thinking about it. |
| 9:18 - 10:24 | Conclusion | | | |