Erasmus+

SCALENEo

Score calculation

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How the game works

Key indicators

The score of a game will be calculated according to several key indicators :

- Count the elements on the cards and classify them into several categories (good, bad, missed, etc.),
- Coloured flag related to crucial elements (Red Flag in medical terms),
- Number of attempts.

Using these different indicators, a comparison can be made between the game played and a reference game previously played by one or more experts. Each game consists of 10 cards, plus the wild card. Each card has a list of elements that will be counted, classified, and compared. So, we compare card by card, element by element. The result is a score and detailed feedback.

The difficulty is to be able to give an accurate score representing the game played, compared with the reference game, while not allowing extreme cases (selection of all the elements on all the cards or selection of none of the elements on any of the cards).

First phase of the game : selecting the elements

Once the game has started, the sentence segments in the text of the clinical case can be selected and assigned to one or more of the hypothesis families in the form of a card. The same can be done by selecting the images, graphs and other resources present in the clinical case. The elements selected can be marked either normal or crucial. This allows to mark the most important ones as different. This first phase of the game is the reflection on the clinical case and the selection of the different elements going into each hypothesis family.

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Second phase of the game : calculation and correction

First attempt

With all the selections and assignments made, you can click on a button which will calculate and display the result.

Things to be displayed :

- The current attempt number related to the max attempt possible
- The flag for each card
- The number of elements correctly sorted related to the expected number of elements on for each card
- A button to show de first score and the brain (related to number of attempt)

The first score is only calculated with the 3 most important cards (mean of the score of the 3 cards). These 3 cards, selected by therapists and experts in the project, are the following :

- Sources of symptoms
- Types of pain
- Precautions and contraindications

The score of other cards will not be involved in this first score. The goal is to have a correct result, without red flags. It means find all crucial elements in all cards. This is the second phase of the game.

Other attempts

If there are still red flags, you will have to refine your selections and try again to calculate the score. You can make a maximum of 3 attempts before moving on to the next phase. When no red flags are present, or when the 3 attempts have been made, we can move on to the third and final phase of the game, the construction of the special card. Or we can restart the game from the beginning. This restart choice is only available after reaching the max attempt number (3 for now) and it will completely reset all the previous choice and items.

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Last phase of the game : the wild card

The special card must reflect the most important and essential information in the clinical case presented. We will therefore have to choose one or more elements from all the elements of the clinical case to make up our special card. This card will be a summary image of the clinical case and the most important points.

Once you have made your choice, you can validate it and obtain the final result. This final result consists of several things:

- The score of the 3 most important cards alone (updated at the last attempt)
- The score of all the cards, excluding the score of the wild card
- The score of the wild card alone
- The flags on each card
- The number of correctly classified elements compared to the expected number of elements in each card
- The final brain (updated according to the number of attempts made)

It is also possible to go and look at the corresponding references, produced by one or more experts, and observe the selections made.

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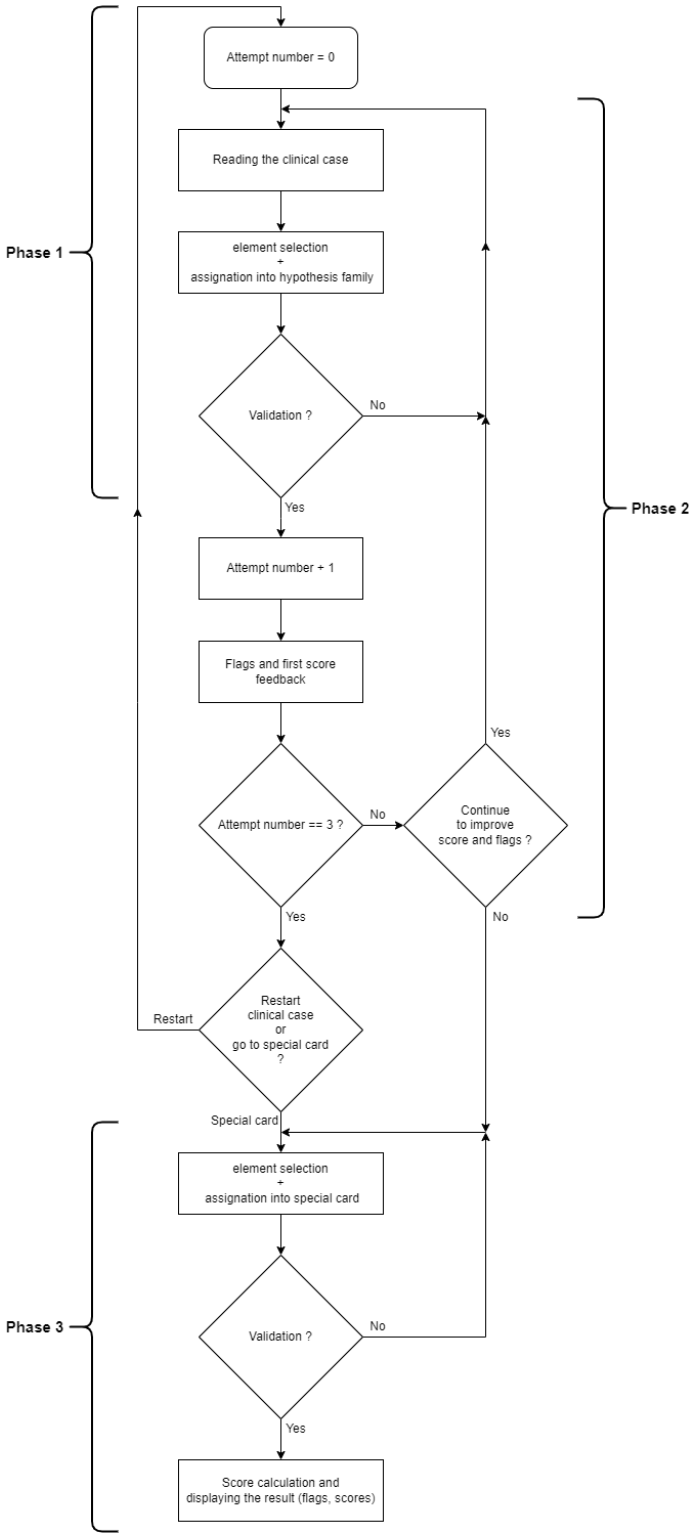

Figure 1 : Sequence of the different phases of the game

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Calculation of the score

Classifying card elements

The elements of a map are compared to the elements of the corresponding map in the reference game. For example, the elements on the "Perspective" card in the game played will be compared to the elements on the "Perspective" card in the reference game. They will be classified into several categories.

Table 1 : Classifying element of one card

Categories	Presence of the element		Type	Example
	Reference card	Game card		
Good normal item	Yes	Yes	Normal	A
Good crucial item	Yes	Yes	Crucial	C
Bad normal item	Yes	Yes	Crucial	G
Bad crucial item	Yes	Yes	Normal	H
Wrong normal item	No	Yes	Normal	E
Wrong crucial item	No	Yes	Crucial	D
Missed normal item	Yes	No	Normal	B
Missed crucial item	Yes	No	Crucial	F
Empty item	No	No	Normal / crucial	I

These different elements will also be counted for each category, and the total number of elements for all the clinical cases will be kept for the rest of the calculations. Figure 2 shows an example of classification with 2 cards and several elements on each (represented by letters from A to I). Crucial elements are marked with an "*" next to their letter.

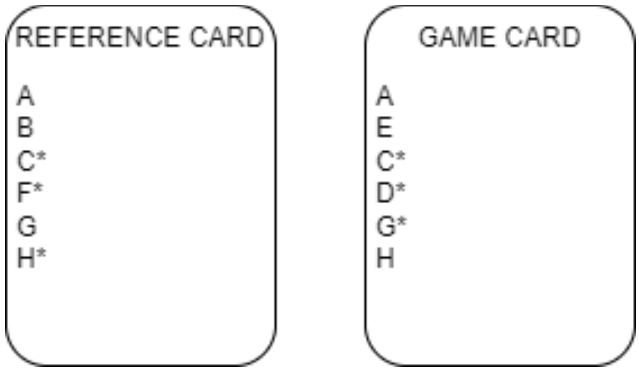

Figure 2 : Example of two cards comparison

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Card score (normal or special card)

The score of a map is calculated using a Cohen's Kappa coefficient on the different elements (classification and number) and in relation to the corresponding map in the reference section. Cohen's Kappa measures the degree of agreement between two observers. In the case of the game, the elements observed are the elements on the cards, and the observers are the reference card and the card played.

Table 2 shows an example of the distribution of elements for the two cards. Box A contains the number of "good" elements. Box B contains the number of "wrong" and "bad" elements. Box C contains the number of "missed" elements. And box D contains the elements not on the two cards, called "empty". The sum of the four boxes gives the total number of elements in the clinical case (those on the cards and those not on the cards).

Table 2 : Example of the distribution of elements for calculating Cohen's Kappa

		Reference card	
		Present	Not present
Game card	Present	A	B
	Not present	C	D

The Kappa coefficient is calculated as follows : $K = \frac{\Pr(a)-\Pr(e)}{1-\Pr(e)}$.

Pr(a) is the proportion of agreement between the two observers and Pr(e) the probability of random agreement. The coefficient will be between 0 and 1, with 0 indicating total disagreement and 1 indicating perfect agreement. One has $\Pr(a) = \frac{(A+D)}{(A+B+C+D)}$ and $\Pr(e) = Pyes + Pno$, with $Pyes = \left(\frac{A+B}{A+B+C+D}\right)\left(\frac{A+C}{A+B+C+D}\right)$ and $Pno = \left(\frac{C+D}{A+B+C+D}\right)\left(\frac{B+D}{A+B+C+D}\right)$.

Table 3 gives an indication of the degree of agreement according to the value of the coefficient obtained.

Table 3 : Kappa's value interpretation

K value	Interpretation
> 0.8	Almost perfect agreement
From 0.61 to 0.8	Strong agreement
From 0.41 to 0.6	Moderate agreement
From 0.21 to 0.4	Weak agreement
From 0 to 0.2	Very weak agreement
< 0	Disagreement

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Once the elements have been counted and classified within a card, we compare them with the corresponding card for the clinical case and calculate the score using Cohen's Kappa. For ease of use, this score will be calculated out of 100. If a card in the reference game is empty and the corresponding card in the game played is also empty, the score will be 100%, because the two observers agree not to put any elements in the cards.

Score of the game

Whatever the score, it will be calculated as the average of the scores for each card concerned, excluding the empty cards on both sides (see previous paragraph). If you don't exclude these empty cards, you could find yourself in a situation where the number of empty cards tilts the score in the positive, even though the cards used are incorrect.

Score of the 3 most important cards

The first score calculated will be that of the 3 most important cards (Sources of symptoms, Types of pain, Precautions and contraindications). The score of the other cards will not be considered. This score will reflect the 3 most important categories and the basis of the clinical case.

Score of the 10 cards without the wild card

This second score, displayed only at the end of the game, will be calculated based on the 10 cards, excluding the wild card. The aim is to give an assessment of all the choices made.

Score for the wild card

The third score will be that of the wild card alone. This will give a summary of the game and the clinical case according to all the analysis and choices made previously.

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Flags and thresholds

The flag on a card can be one of 3 colours : yellow, red or green. The colour will be determined according to the elements present on the card and their number, and by comparison with the corresponding card in the reference game. Once each comparison has been made, a flag will be assigned to each card. The colour of this flag is determined as follows.

- Red
    - If crucial elements have been missed or marked as normal (1 or +)
    - If no normal elements have been found
    - If one card is empty and the other is not (either items missed or items selected when there should be none)
- Green
    - If the 2 cards are empty (reference and game)
    - If all the crucial elements found and most of the normal elements (above a threshold)
- Yellow
    - If all the crucial elements found and some of the normal elements (below a threshold)

To determine whether the flag's colour is green or yellow, you need to calculate a flag score (set between 0 and 1) and determine whether it is below or above a threshold. The threshold is currently set at 0.5.

The flag score is determined as follows:

$$Flag\ score = \left(\frac{good\ items + empty\ items}{total\ items}\right)\left(\frac{good\ items}{total\ needed\ items}\right)$$

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The "good items" are the number of good items on the 2 cards with the right type, the "empty items" are the items not on the 2 cards. The total number of items in all the clinical cases is represented by "total items", and the number of items expected on the card is represented by "total needed items".

We consider the items on the card and those not on the two cards. This shows that the player has understood which items should be on the card and which should not.

In this way, we can count whether the expected elements are there and in sufficient number in relation to the total number of elements. Without the second part, which multiplies the first, you could put no items on the card, and still get a very good score (because empty item would be high and close to total items).

This score will be between 0 and 1, and will be compared with the threshold set above. If the score is above the threshold, the flag will be green, otherwise it will be yellow. All other conditions are checked before the score is calculated.

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Brain

The level of the brain is calculated according to the number of attempts needed to eliminate all the red flags. The maximum number of attempts is currently set at 3.

- 1st attempt : Gold
- 2nd attempt : Silver
- 3rd attempt : Bronze