CREATIVINI: AN AUGMENTED REALITY CARD GAME TO PROMOTE THE LEARNING OF THE REASONING PROCESS OF A TECHNICAL MANAGEMENT ROUTE FOR MAKING WINE

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Abstract:

Context and purpose of the study - Nowadays, the entire viticultural and enological process is wisely thought out according to the style of wine to be produced and the local climatic conditions. Acquiring the approach of a technical management route specific for wine production remains a complex learning process for students. To enhance such learning, The Ecole d'Ingénieurs de PURPAN (PURPAN), an engineering school located in Toulouse southwest France, has recently developed Creativini, a collaborative card game in English made of 150 cards spread into 14 batches. Students in groups of 3 to 6 must design a technical production route, from plant material to bottling. The game is played in ascending order of batch number with the three first batches (wine style, climate and production system) and the last one (hazard) being drawn. Based on previous research, augmented reality (AR) contents were included in the game to promote the commitment, the motivation of students in this learning, and to favor the anchoring of knowledge by offering a strong experience. The objective of this work was to investigate the added value brought by AR.

Material and methods – Thirty-six 20 years old students from PURPAN were divided into 6 groups of 6 students to play a game in March 2022. Half of them were allowed to get access to the AR content (AR group), while the other half was not. For these latter groups, the AR content was replaced by some text to read (without AR group). The knowledge of the students was assessed through a quiz composed of 20 questions using a learning management system (LMS) before to start and at the end of the game. At the end of the game, another questionnaire was also used to evaluate how the educational medium was perceived, and the emotions felt by the students during the game. Knowledge scores were treated through a one-way analysis of variance (ANOVA) treatment to assess the impact of AR.

Results – The questionnaire revealed that both groups enjoyed the game and were satisfied by the session which confirms the relevance of the medium. Those from the AR group experienced more positive emotions (pleasure/hope) than those from the group without AR who felt more stress and boredom. A significant difference was observed for the knowledge score between the two groups at the beginning of the game (5.1/20 with AR ; 8.1/20 without AR) highlighting an initial heterogeneity in student composition. However, at the end of the game, no significant difference was observed between the two treatments (9.5/20 with AR; 10.8/20 without AR) indicating that AR students managed to catch up. It remains unclear if this benefit is due to the AR content or to a lesser commitment of the students who played without AR and exhibited an initial higher level of expertise in viticulture and enology.

Keywords: card game, augmented reality (AR), learning, students, process, viticulture, winemaking.

1. Introduction

Wine grapevine is today a crop spread worldwide, in more than 90 countries including some temperate and tropical regions. Gone are the days when the winemaker was managing all his vineyards in the same way, vinified all his grapes according to an identical process, and then selected at tasting the most qualitative batches at the end of vinification. Nowadays, the entire viticultural and winemaking technical route, from the choice of the genotype to the reasoning of the wine stopper, is judiciously considered according to the style of wine to be elaborate. Acquiring the approach of a technical management route specific for wine production remains a complex learning process for students. To apprehend such approach, The Ecole d'Ingénieurs de PURPAN (PURPAN), an engineering school located in Toulouse southwest France, has developed Creativini, a collaborative card game in English, where the students in teams of 3 to 6 have to succeed in designing a technical itinerary of production. This game which is composed of 150 cards divided into 14 batches contains augmented reality (AR) content providing information or explanations on the cards.
Research has highlighted the benefits of the gamification of educational activities or multimedia training to develop motivation, memorization of knowledge, interactivity or skills related to problem solving (Kalogiannakis et al., 2021, Plass and Kalyuga, 2019 and Mayer 2019). Moreover, the literature emphasized that AR can be of interest in a learning situation (Chen et al., 2017) especially when integrated into a game (Schez-Sobrino et al. 2020).
The objective of our work was to study the impact of AR in the context of a serious game scenario on the commitment and motivation of students in this learning, the anchoring of knowledge and the development of the targeted skills, by offering the learner an strong learning experience.

2. Material and methods

2.1 Rules and curse of the game

The objective of Creativini is to create a technical route suitable for the production of a given wine product or wine style (fresh and fruity white wine, full bodied white wine, rosé wine, light and fruity red wine, full bodied red wine, bottle fermented sparkling wine, semi-sweet white wine and brandy). It will allow the players to discover and understand the purpose of some vineyard and cellar operations occurring during the grape and wine production, and will help them to memorize the main English technical terms commonly used in viticulture and enology. The game is composed of 145 cards printed on both sides divided into 14 different batches, and of 5 empty cards that can be freely used by players to suggest a missing operation (Figure 1). This game is mainly addressed to people with a basic wine knowledge or who are interested in wine. However, it can also be played by people with an advanced wine knowledge such as wine experts. While most of the players can look and read both sides of the cards, it is suggested for experts to play only with the recto side, on which only the title of the card is mentioned (Figure 2). This game contains augmented reality content providing information or explanations on the cards that requires to download and install the ARGOPlay application on a cell phone (Figure 3). The game can last for anything between 30 minutes and 3 hours, and can be played alone or better in teams of 3 to 6 players. Each batch of cards also contain a knowledge card that is not to be played but will provide players with information or additional explanations through augmented reality content.
The play will start by blindly drawing one card from batch 1, 2 and 3 that will assign to the players a wine product among the seven available previously described, a climatic background (continental, maritime or Mediterranean) and a production system (conventional, organic or biodynamic viticulture). Then, the game must be played by ascending order of batch number from 4 to 13 (4=grape variety, 5=plant density, 6=soil management, 7=optional cultural operation, 8=maturity of the grapes, 9=harvesting method, 10=winemaking operation, 11=biochemical reactions, 12=enological inputs, 13=corking). For each batch, players must select the most appropriate cards for the elaboration of their product based on their own knowledge or on the information available on the back of the card. Finally, one card from batch 14 associated to a climatic or microbiological hazard such as hail or frost damages or *Brettanomyces* spoilage must be blindly drawn. Players must discuss its impact on their technical route and think in preventing or curative methods.

Some cards include a money icon meaning that the action or operation has a high cost of implementation. The number of cards used in the technical route displaying such icon must be adapted to the price positioning of the wine : one for basic wines with an average retail price around 5 euros in Europe or 10 euros in the USA (fresh and fruity white wine, rosé wine and light and fruity red wines); three for premium wines sold above 10 euros in Europe or above 20 dollars in the USA (the other four wine products or wine styles). The use of mechanical pruning and resistant varieties (i.e. Artaban) strongly reduces production costs which allows the players to benefit from an extra high-cost operation card. Organic and biodynamic wines are usually associated with higher production costs and a better commercial valuation. If this production system is drawn, the players will also benefit from an extra money card allowance. Some cards also integrate a "forbidden in organic or biodynamic viticulture" icon meaning that the action or operation is forbidden in organic or biodynamic viticulture. Indeed, these systems prohibit the use of any synthetic pesticides (herbicides, fungicides and insecticides), some physical treatments and enological inputs in the winery.

2.2 Conditions of the experiment

Thirty-six 20 years old students in their third year out of five at PURPAN were divided into 6 groups of 6 students to play a game in March 2022. Half of them were allowed to get access to the AR content (AR group), while the other half was not. For these latter groups, the AR content was replaced by some text to read (without AR group). The knowledge of the students was assessed through a quiz composed of 20 questions just before to start and at the end of the game, in the last 15 minutes of the session, using the Moodle learning management system (LMS).
At the end of the session, another questionnaire was also used to evaluate how the educational medium was perceived, and the emotions felt by the students during the game. The questionnaire composed of 30 questions used a 5-point Likert scale, from "1=totally disagree" to "5=totally agree". It was based on the Instructional Materials Motivation Survey questionnaire (IMMS) previously validated by Hauze & Marshall (2020). It aimed to measure the dimensions of presence (spatial and social perception, attention paid to the environment and feeling of sharing an environment), emotions (pleasure, enthusiasm, hope and courage for the positive ones, stress, anxiety, embarrassment, anger, despair, and boredom for the negative ones), and motivation (satisfaction, relevance, attention, and trust). The duration of both test was estimated at 7 minutes at most.
Knowledge scores rated to 20 points and responses to each question of the IMMS questionnaire were treated through a one-way analysis of variance (ANOVA) treatment to assess the impact of AR.

3. Results and discussion

The questionnaire related to educational medium revealed that both groups enjoyed the game and were satisfied by the session which confirms the relevance of the card game.
Those from the AR group experienced in trend more positive emotions (pleasure/hope) than those from the group without AR who felt more stress and boredom. Differences between the two groups were only statistically different for two questions at $P<0.05$: the first one concerning perceived emotion, with the students from the AR group feeling more confident as they understood better the content of the lecture; the second one related to presence with the AR group considering that learning with this type of support required a lesser mental effort.
A significant difference was observed at $P<0.05$ for the knowledge score between the two groups at the beginning of the game (5.1/20 with AR ; 8.1/20 without AR) highlighting an initial heterogeneity in student composition. However, at the end of the game, no significant difference was observed between the two treatments (9.5/20 with AR; 10.8/20 without AR) indicating that AR students managed to catch up. It remains unclear if this benefit is due to the AR content or to a lesser commitment of the students who played without AR and exhibited an initial higher level of expertise in viticulture and enology.

4. Conclusions

Our results which are still preliminary indicates that the Creativini card game was well perceived by the students who tested it. Overall, positive indicators related to presence, emotions and motivation were higher for the AR

group even if only two out of the thirty questions of the educational medium questionnaire proposed at the end of the session enabled to discriminate the two groups. More work is necessary to understand the benefits brought by the AR content and this experiment will be renew soon. The initial knowledge questionnaire will be proposed the day before the session and its results will be used to constitute homogenous groups of students, in order to avoid any bias.

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Figure 1: The Creativini game is composed of 145 printed cards divided into 14 different batches, and of 5 empty cards that can be freely used by players to suggest a missing operation

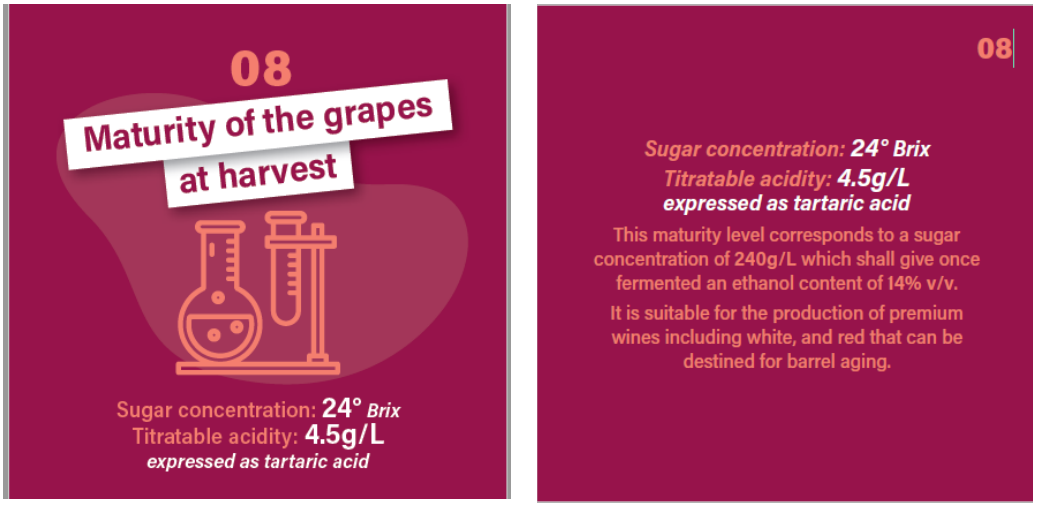

Figure 2: Each card contains a recto and a verso side. While most of the players can look and read both sides, it is suggested for experts to play only with the recto side, on which only the title of the card is mentioned.

Figure 3: The game includes some augmented reality content providing information or explanations on the cards in the form of video clips. Such content can be accessed on any smartphone using the ArgoPlay app.