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Fostering Knowledge and Awareness about Healthy Nutrition through Science-based Educational Escape Games

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Abstract
The prevalence of diseases stemming from poor nutrition emphasizes the importance of educating people about healthy eating habits. One approach to achieving this is through educational escape games, which embody the features of a situated learning environment. Utilized the situated learning theory as a theoretical and methodological framework, the goal of our study was to examine the role of science-based educational escape games in facilitating knowledge construction and awareness about healthy nutrition. The study was conducted in the setting of a science teacher preparation program, where 165 preservice science teachers were engaged in an escape game named *Zombie Attack* about proteins in food and the human body. The study applied the pretest-posttest design, in which quantitative and qualitative data were collected concurrently before and after game participation. The findings showed that the escape game experience had a positive effect on the participants' knowledge gain associated with topics such as energy of macronutrients, protein percent daily value, and proteins in the body. With regards to awareness about healthy nutrition, the study identified five types: Health, Composition, Environment, Source, and Ethics, with a significant gain in all categories following the escape game experience. Overall, the study advocates the use of escape games as a method for fostering interactive learning of scientific concepts, encouraging collaborative problem-solving, and facilitating self-reflection activities.

Keywords Escape Games · Healthy Nutrition · Preservice Science Teachers · Science Education · Situated Learning

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Introduction

The consumption of processed food and unhealthy diet have been linked to a variety of health issues, such as heart diseases, diabetes, obesity, and various types of cancer. Changing unhealthy dietary habits can be achieved by incorporating food and nutrition literacy into the science curriculum (Follong et al., 2022; WHO, 2020). Like many subjects, food and nutrition is better studied when knowledge is built experientially, with a connection to daily life. One way of doing so is by involving students in game-based learning (e.g., Abdollahi et al., 2021; Baranowski et al., 2019). Game-based learning comes in a variety of forms; one example is the 'escape game' format, in which players are required to work in groups and solve puzzles in order to escape a locked room in a limited time span (Yachin & Barak, 2024). In recent years, there has been a rising trend in developing escape games for educational purposes (Avargil, 2022; Veldkamp et al., 2022; Yachin & Barak, 2024). Educational escape games involve students in teamwork with the aim of solving content-specific puzzles. They are popular in higher education, in academic training of nurses, pharmacists, and physicians as they can imitate their work experience (e.g., Eukel et al., 2020; Hawkins et al., 2020). For example, a study by Kinio and colleagues (2017) assessed the impact of a vascular escape room on medical students' motivation, satisfaction, and engagement in learning. The students reported an increased knowledge and interest in vascular surgery, and the study concluded that by combining knowledge-based problems and technical skills, escape games can be used as effective learning environments (Kinio et al., 2017). The literature presents exemplary practices of educational escape games applications (e.g., Avargil et al., 2021; Buggé & Resnick, 2023; Haimovich et al., 2022;); however, little attention is given to game design methodology.

Escape Games and Science Education

In science education, escape games are used for simulating the scientific laboratory and the way scientists think and work (Avargil, 2022; Haimovich et al., 2022; Peleg et al., 2019). For example, Buggé and Resnick (2023) developed a climate change escape room for introductory physics students. Another study by Peleg and colleagues (2019) designed a mobile escape room that consisted of lab-based activities for high school students. The study results indicated an increase in students' perceptions of effective teamwork and self-efficacy (Peleg et al., 2019). Another example is the "Masked Scientist" escape game, in which students were asked to identify a scientist by applying their knowledge of basic topics in chemistry (Haimovich et al., 2022). This included topics such as: the atomic model, radioactivity, and the periodic table. The game involved students in building scientific knowledge through connections to history, human rights, and sustainability, as well as interesting chemical facts related to everyday life (Haimovich et al., 2022). Another example is a chemistry-themed escape-room that was built as an alternative learning and assessment environment (Avargil, 2022). The study found that the game experience fostered students' chemical content knowledge, as well as their collaboration, communication, and higher-order thinking skills.

Overall, studies show that escape games provide tangible learning environments that offer hands-on activities. They engage students in authentic practices that involve teamwork, knowledge sharing, and collaboration (Avargil, 2022; Veldkamp et al., 2020; Yachin & Barak, 2024). Even with the positive results, studies point to challenges that are asso-

ciated with educational escape games. This includes the significant expenses associated with their development and maintenance, safety considerations, and the potential stress on students due to the competitive nature of the game (Veldkamp et al., 2020). Thus, escape game studies focus mainly on students' game experience, engagement, and motivation (e.g., Abdollahi et al., 2021; Veldkamp et al., 2022); they are commonly based on participants' self-report via post-intervention surveys. Studies that apply a pre-test post-test intervention design in the evaluation of escape games, are rare (Yachin & Barak, 2024). In addition, educational escape games typically derive their approaches from recreational games, with little, if any, grounding in learning theories (Veldkamp et al., 2022; Yachin & Barak, 2024). To address these gaps, the current study utilized the situated learning theory as a theoretical and methodological framework for the design, implementation, and investigation of science-based escape games.

Escape Games and Situated Learning

Guided by the work of Lave and Wenger (1991), the situated learning theory maintains that meaningful learning occurs when learners are active participants by creating meaning from engaging in authentic activities of daily living. Situated learning environments have typical design elements, including authentic context and activities, access to experts' knowledge, experiencing various roles and identities, engaging in collaborative knowledge construction, and self-reflection (Yachin & Barak, 2024; Bell et al., 2013; Harrington & Oliver, 2000). This approach corresponds with social constructivist approaches that have been used to promote effective science teacher education (e.g., Barak, 2017a; Barak, Yachin & Erduran, 2023; Bell et al., 2013; Sadler, 2009). The situated learning approach emphasizes the connection and interdependence between the learning process and the physical, social, and cultural environments in which it takes place (Bell et al., 2013; Lave & Wenger, 1991). Thus, it can provide the theoretical and methodological basis for connecting game design with science education (Yachin & Barak, 2024; Klopfer et al., 2018).

The situated learning theory is pertinent to the design and application of science-based escape games, as it emphasizes the construction of meaningful interactions between the learners and the environment in which the learning process occurs (Yachin & Barak, 2024). Situated learning encompasses four main features: *authentic situations*, *scientific contents collaborative learning* and *self-reflection*. First, situated learning environments engage learners in *authentic situations*, enabling them to integrate into a real-life situation, and by that improve learning efficacy (Bozalek et al., 2013; Chiu et al., 2018). Second, situated learning environments present learners with scientific contents and experts' knowledge, exposing them to various viewpoints and professional information (Collins et al., 1989, Lave & Wenger, 1991). Third, *collaborative learning* through team work fosters knowledge construction (e.g., Cohen et al., 2020; Abdollahi et al., 2021). Fourth, *self-reflection* engages learners in metacognitive operations while critically analyzing their learning process and behavior (Collins et al., 1989; Harrington & Oliver, 2000). While educational escape games may exhibit characteristics of situated learning (e.g.,Yachin & Barak, 2024), little consideration has been given to the dynamic interaction of these features with learning outcomes. Additionally, there is a dearth of pedagogical frameworks that systematically integrate these features into the design of escape games with the purpose of maximizing their potential for enhancing the learning experience and outcomes.

Research Goal and Questions

Guided by the situated learning theory, the goal of the current study was to examine the role of science-based educational escape games in facilitating knowledge construction and awareness about healthy nutrition among preservice science teachers. This goal raised the following questions:

1. To what extent can a situated science-based educational escape game promote knowledge construction and awareness about healthy nutrition?
2. What are the relationships between the presence of the situated learning components in the escape-game and participants' knowledge gain and awareness about healthy nutrition?

Method

Research Participants and Setting

The study was conducted in the setting of a science teacher preparation program, where 165 preservice science teachers engaged in an escape game about 'Proteins in food and the human body'. The participants ages ranged from 22 to 38 years (M = 31, SD = 7.1), 68% females and 32% males. They were all graduates of science departments (chemistry, physics, biology, computer science), holding a BSc degree (75%), a master's degree (21%), or a PhD degree (4%), studying to become secondary teachers. Designed as a situated science-based escape game (Yachin & Barak, 2024), the *"Zombie Attack"* experience included ten 'puzzles' (i.e. riddles and learning activities), with a time frame of about an hour to complete all tasks in groups of four to five participants. Each puzzle represented a scientific concept, such as: The food pyramid, Energy of macronutrients, Food energy calculation, Protein daily value, Protein intake, Essential amino acids, Complete protein foods, Complementary proteins, Protein in our body, and Global aspects of protein consumption.

The game was situated in the setting of an old house – a kitchen and a pantry, with different types of food. Its backstory portrays a situation where the world is overrun by zombies, and they are on the brink of attacking the house where the players are taking refuge. The only way to survive is to learn about healthy food consumption, since this type of zombies refrain from attacking people who maintain a well-balanced diet.

The scientific content presented in the game was designed to engage the participants with four types of knowledge: disciplinary, interdisciplinary, procedural, and epistemic knowledge (OECD, 2019). For example, *disciplinary knowledge* included information about protein consumption, such as the recommended protein percent daily value or a list of foods containing complete proteins. *Interdisciplinary knowledge* included information about industrial and environmental aspects of food production. *Procedural knowledge* included information about problem-solving activities, such as calculating food energy. *Epistemic knowledge* included information about the nature of science and scientists' worldviews.

Moreover, the game was designed to apply the four main components of the situated learning approach. First, the game demonstrates *authentic situations* through real-life activi-

ties, such as identifying nutrients in food packages. Second, the game demonstrates *scientific contents* through instruction cards and infographics displayed in the room. Third, the game encourages *collaborative learning* through activities that require teamwork. Forth, the game encourages *self-reflection* through questions about their learning experience. To this end, each puzzle was designed to include three main parts: A scientific introduction, the learning objective, and the collaborative activity. An example of a puzzle about 'protein %DV' is presented in the following.

Scientific Introduction The percent Daily Value (%DV) indicates the proportion of a certain nutrient in one serving of food, compared with the recommended daily intake. With regards to proteins, the quantity that should be consumed per day depends on factors such as age, gender, health condition, physical activity, and more. Official nutrition organizations recommend a minimum protein intake. The Recommended Dietary Allowance (RDA) for protein is 0.8 g of protein per kilogram of body weight, or 0.36 g per pound. This amounts to at least 56 g per day for the average man and at least 46 g per day for the average woman. This is the minimum quantity to keep us from getting sick, but for daily function, it is better to take larger amounts.

Learning Objective To practice the calculation of protein %DV from real food products.

Collaborative Activity The students are provided with eight food products, such as a milk carton, sliced sausage, jar of peanut butter, bag of soybeans, bag of tofu, canned tuna, etc. They are asked to provide the right combination of foods, of which their protein %DV sums up to 0.8 g precisely. Each food product has a graphical code, and the correct combination of codes indicates the numbers: 0808 that can be used to unlock the next puzzle.

Research Method and Tools

The study applied the single-case pretest-posttest design (Dugard et al., 2012), in which quantitative and qualitative data were collected concurrently, before and after game participation. To answer the first research question, pre- and post-questionnaires were administered to indicate the extent to which the escape game promotes knowledge and awareness about healthy nutrition. To answer the second research question, a path analysis model was generated to indicate the relationships between the situated learning components and participants' knowledge and awareness about healthy nutrition.

The pre- and post-escape game questionnaires included two parts. The first part - *Knowledge*, consisted of eight multiple-choice questions on topics related to nutrition and food consumption, such as: What nutrients form the basis of energy calculation of food products? How many grams of protein are recommended to consume per day? What are essential amino acids? What are complementary proteins? How much of the human body is protein? Scores per participant ranged on a scale from 0 (all answers are incorrect) to 100 (all answers are correct). The internal consistency of the scale, measured by Kuder-Richardson (KR-20), was 0.83.

The questionnaires' second part - *Awareness*, included a 'reflective photo' query with an open question, validated in previous studies (e.g., Barak, 2017b; Barak & Green, 2021).

This included a photograph showing a herd of cows in a meadow, prompting the participants to look at the photo and write their thoughts about food and nutrition. The participants' written answers were analyzed using the inductive (conventional) content analysis approach, allowing key concepts to flow from the data (Hsieh & Shannon, 2005). The emerging concepts were labelled into a coding scheme, which was used to sort data into subcategories and then into categories (Creswell & Creswell, 2018). Based on this coding scheme, each participant received a numerical score, according to the following key: providing no answer (0 points); providing the same answer in the posttest as in the pretest (1 point, as a constant); displaying additional excerpts within the same category (2 points); displaying additional excerpts related to a new category (3 points). Inter-rater agreement with three experts in science education was calculated at a Cohen Kappa coefficient of 0.85 (Cohen, 1968).

A path analysis model was generated to examine the relationships between situated learning (via its four components: authentic situation, scientific content, collaborative learning, and self-reflection), and participants' gain of knowledge and awareness. The path analysis was used to illustrate correlations among the set of variables, applying multiple regression statistics to identify causality (Lleras, 2005).

Ethical Considerations The participants were provided with an informed consent form detailing the research goal and process; they were informed that participation is voluntary, and they were given a choice to withdraw at any time. Names and contact information were concealed, data were analyzed in the aggregate, and the study followed the university's ethical guidelines and received IRB approval.

Findings

Knowledge about Healthy Nutrition

The analysis of participants' answers to the multiple-choice questions about indicated an increase in knowledge ($M_{pre} = 48.82$, $SD = 27.47$; $M_{post} = 62.60$, $SD = 26.18$), with statistical significance $t(164) = 9.63$, $p < .01$. Based on a scale of 100 points, Table 1 shows the results of a paired sample t-tests, before and after participating in the science-based escape game.

Table 1 shows that in the pre-questionnaire, the participants were quite familiar with the topic of the nutrients that form the basis of energy calculation of food products ($M_{pre} = 82.4$, $SD = 27.2$). The questions with the lowest mean scores were "How many grams of protein are recommended to consume per day?" and "What are complementary proteins?" ($M_{pre} = 33.4$, $SD = 27.8$; $M_{pre} = 35.5$, $SD = 25.6$, respectively). In the post-questionnaire, the participants received the highest mean score for the question about the nutrients that form the basis of energy calculation ($M_{post} = 82.4$, $SD = 27.2$). Other questions that received high mean scores were "What are essential amino acids?" and "What are complete proteins?" ($M_{post} = 81.6$, $SD = 25.2$; $M_{post} = 80.6$, $SD = 25.5$, respectively). The topic that received the lowest mean scores was about the recommended amount of protein to consume per day ($M_{post} = 58.2$, $SD = 21.0$). This topic also received the lowest mean scores in the pre-questionnaire, and it seems that the escape game experience slightly advanced the participants' knowledge. Overall, the analysis showed statistically significant gains in participants' knowledge

Table 1 t-test analysis of knowledge questions on pre- and post- questionnaire ($n=165$)

Food and nutrition knowledge questions	pre-questionnaire		post-questionnaire		*t*	*p*
	Mean	SD	Mean	SD		
1. How many calories are there in 1 gram of protein?	36.6	27.5	77.5	26.1	9.31	0.000
2. What nutrients form the basis of energy calculation of food products?	82.4	27.2	88.3	23.4	1.71	ns
3. How many grams of protein are recommended to consume per day?	33.4	27.8	58.2	21.0	2.40	0.023
4. What are essential amino acids?	56.4	22.4	81.6	25.2	3.30	0.003
5. What are complete proteins?	58.6	23.2	80.6	25.5	3.26	0.001
6. What are complementary proteins?	35.5	25.6	75.3	20.0	5.04	0.000
7. How much of the human body is protein?	36.7	25.3	72.4	29.1	3.72	0.001
8. What are the functionalities of proteins in our body?	51.6	31.1	78.1	28.4	2.54	0.014

construction in all topics, except for question #2, as this question received high scores in the pre-questionnaire, which may suggest a 'ceiling effect'. With regards to participants' self-report, data analysis indicated a positive effect of the escape game experience on participants' knowledge gain ($M_{pre} = 2.98$, $SD=1.01$; $M_{post} = 3.14$, $SD=0.91$), with statistical significance ($t(164)=2.98$, $p<.01$).

Awareness about Healthy Nutrition

The participants' awareness about healthy nutrition was examined through the analysis of the 'reflective photo' query, yielding 346 excerpts in the pre-questionnaire and 742 excerpts in the post-questionnaire, indicating an increase of more than double of relevant quotes. An inductive content analysis of the excerpts generated five main categories of awareness gain: (a) Health – awareness to issues related to balanced diet or unhealthy food products, (b) Composition – awareness to food ingredients such as macronutrients, minerals, and vitamins, (c) Environment – awareness to environmental issues such as climate change, land usage, and sustainability, (d) Source – awareness to the source of different foods such as plant-based or animal-based foods, and (e) Ethics – awareness to ethical issues such animals breeding conditions. Examples of participants' excerpts are as follows:

> *Milk and meat supplied by cattle* [Source] *are examples of complete proteins* [Composition], *which are important for our health* [Health], *but the production process has a relatively negative environmental impact* [Environment].
> *Industrial cattle farming raises ethical dilemmas since the animals' breeding conditions are harsh and they are treated as meat factories* [Ethics].
> *Excessive consumption of 'red meat'* [Source] *might hinder our health as it may increase the risk of various types of cancer* [*Health*]. *It is also bad for the environment since cattle releases methane - a greenhouse gas that effects our climate* [Environment].
> *Animal-based foods such as beef* [Source] *include saturated fat and cholesterol* [Composition] *that can increase the risk of heart diseases* [Health].

The awareness categories and their distribution in the pre- and post-questionnaires are presented in Fig. 1.

Figure 1 shows that participation in the science-based escape game significantly increased awareness about various aspects of healthy nutrition and food consumption. Wilcoxon signed-rank test indicated a statistically significant increase in the total number of excerpts between the pre- and post-questionnaire ($Z=13.12$, $p=.000$). The significant increase was indicated in each awareness categories: Health ($Z=4.98$, $p=.005$), Composition ($Z=7.85$, $p=.002$), Environment ($Z=9.32$, $p=.000$), Source ($Z=9.46$, $p=.000$), and Ethics ($Z=2.76$, $p=.045$). The significant gains in participants' awareness reflects a process of raising attentiveness to a variety of food-related aspects, especially with regards to food sources and environmental issues related to food consumption and waste.

Situated Learning, Knowledge and Awareness Gain

The relationships between situated learning, through the four components, and participants' gain of knowledge and awareness, were examined through Path analysis (PA) model, which is a special case of structural equation modeling (SEM), where background variables are observed to control for possible confounding effects (Lleras, 2005). Findings indicated positive direct and indirect effects of the situated learning components on knowledge, awareness, as presented in Fig. 2.

Figure 2 shows positive statistically significant correlations between the four situated learning components ranging from ($r=.53$, $p<.001$) to ($r=.35$, $p<.001$). This indicates that the four situated learning components are interrelated but still distinctive. The analysis also identified two paths, each pointing to a different explanation for the increase in participants' awareness about healthy nutrition. First path indicates 'Scientific content' as an affecting factor on participants' 'Knowledge gain' ($r=.15$, $p=.043$), which, in turn, mediates the effect of 'awareness gain' ($r=.17$, $p=.036$). The second path indicated 'Self-reflection' as an affecting factor on participants' 'Awareness gain' ($r=.23$, $p=.013$). The situated learning components of 'Authentic situation' and 'Collaborative learning' were found as indirect affecting factors on knowledge and awareness gain, through their positive correlations with 'Scientific content' and 'Self-reflection'.

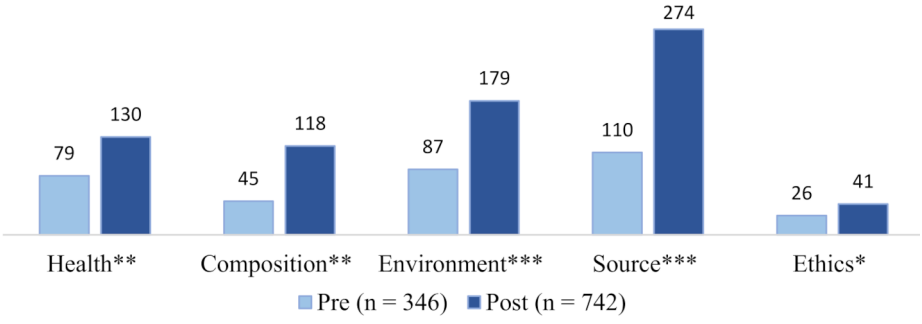

Fig. 1 Awareness categories and their distribution in the pre- and post-questionnaires
*$p<.05$ **$p<.01$, ***$p<.001$

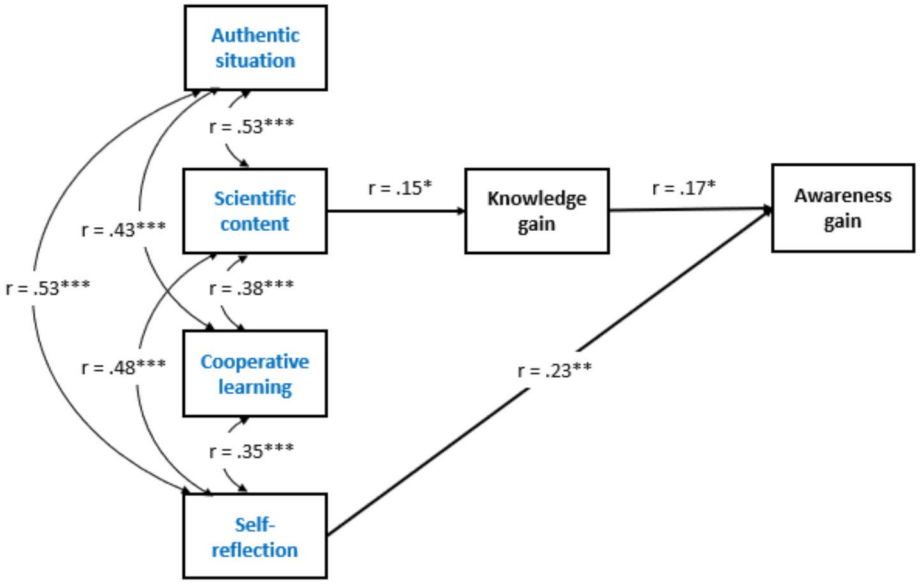

Fig. 2 Situated learning components, knowledge gain, and awareness gain relationships
*$p \leq .05$, **$p \leq .01$, *** $p \leq .001$

Summary and Discussion

Designed as a situated science-based educational escape game (Yachin & Barak, 2024), the *"Zombie Attack"* game experience indicated a positive effect on the promotion of knowledge about healthy nutrition. The participants significantly improved their knowledge about topics such as energy of macronutrients, protein percent daily value, and proteins in the body. They also improved their ability to identify essential amino acids, name complete proteins, and perform food energy calculations. These results can be associated with effective puzzle design, which was guided by the situated learning theory, taking into account four main components: *authentic situations*, *scientific contents collaborative learning* and *self-reflection* (Bozalek et al., 2013; Chiu et al., 2018; Lave & Wenger, 1991; Sadler, 2009). The affirmative results point to the advantages of situated escape games and their integration into science education (Yachin & Barak, 2024).

With regards to nutritional habits, the prevalence of diseases stemming from poor nutrition emphasizes the importance of educating people about healthy eating habits. This can be achieved by fostering food and nutrition literacy (Baranowski et al., 2019; Follong et al., 2022; WHO, 2020). In accordance, the current study shows that the situated science-based educational escape game had a positive impact on participants' nutritional knowledge; yet, the topic that received the lowest average scores in both the pre-and post-questionnaires, was the recommended daily amount of protein consumption. This may imply that proteins are perceived as an available macronutrient consumed in an appropriate amount, and therefore there is no need to pay attention to how much it should be consumed. Another explanation may be related to the puzzle design, and the importance of giving greater emphasis to this topic (Abdollahi et al., 2021; Yachin & Barak, 2024).

With regards to awareness about healthy nutrition, the study identified five categories: Health – awareness to issues related to balanced diet or unhealthy food consumption, Composition – awareness to food ingredients, Environment – awareness to food intake and waste on the ecosystem, Source – awareness to the source of different foods, and Ethics – awareness to moral issues. The study results indicated that participation in the science-based escape game significantly increased awareness for all five categories, with distinct gains for Health, Composition, Environment, and Source. Regarding the Ethics category, less text excerpts were specified, indicating the need to place more emphasis on explicit instruction that is focused on ethical issues involving food consumption and waste.

In the current study, awareness was examined through the visual methodology of 'reflective photos' or photo-elicitation, in which photographs are used to evoke thoughts and feelings (Barak & Green, 2021; Richard & Lahman, 2014). This method allows participants to decide what is important and where to elaborate, triggering thinking processes and yielding rich answers (Richard & Lahman, 2014). The advantage of this approach lies in the photos or drawings that have no direct connection to the research topic; thus, serve as the context for the participant's deep thinking and responses (Barak, 2017b; Richard & Lahman, 2014).

The participants' awareness gain following the science-based escape game experience increased in all categories. This finding corresponds with other studies that indicated awareness raising among participants following game-based learning in science-related topics (e.g., Graafland et al., 2017; Perini et al., 2017). The highest increase in awareness, was in the 'Source' category, which included assertions about plant-based vs. animal-based food. High awareness increase was also depicted in the 'Environment' category, which included expressions about gas emission, global warming, food waste, water contamination, and land pollution. This suggests that following the game, the participants were able to develop their knowledge and a wider viewpoint; a progression that is characteristic to situated learning.

The examination of the interrelationships between the four situated learning components indicated that they were related to the same construct but were still distinctive. Similar relationships were described in studies on educational games, portraying linkage between authentic learning experience, collaborative teamwork, and reflection processes (e.g., Yachin & Barak, 2024; Eukel et al., 2020; Eukel &Morrell, 2021). With regards to the relationships between the situated learning components and participants' gain of knowledge and awareness, the correlations between the variables were relatively low, but they were statistically significant. This suggests that the relationships, although relatively week, are not due to random chance, but rather indicate patterns that can be strengthened with a larger sample size (Field, 2018). Looking at these patterns, two interesting findings emerged. First, that an escape game that purposefully focuses on scientific content has the potential to develop the construction of scientific knowledge, which in turn, has a positive effect on participants' awareness about healthy nutrition. Second, there is a direct link between self-reflection tasks and awareness gain, which strengthens the understanding of the importance of the explicit-reflective approach in science education (Witucki et al., 2023).

Following the results presented above, our study suggests three main insights. Firstly, the situated learning approach can effectively inform the design of science-based educational escape games (Yachin & Barak, 2024). Secondly, in order to construct knowledge, the game environment should incorporate explicit scientific content and encourage self-reflection, i.e., apply the explicit-reflective approach (Witucki et al., 2023; Yachin & Barak, 2024). Thirdly, the 'reflective photo' method was deemed valuable for illustrating and dis-

tinguishing types of awareness and awareness gains (Barak, 2017b; Barak & Green, 2021). Overall, the study advocates the use of escape games as a method for fostering interactive learning of scientific concepts, encouraging collaborative problem-solving, and facilitating self-reflection activities.

Limitations and Further Research

This study applied a rigorous approach to data collection and analysis; yet, two limitations should be noted to guide future research. The first relates to the escape games' topic - 'proteins in food and the human body', which is very focused and specific. Further research should be conducted to expand on nutrition and food-related issues by designing new escape games on carbohydrates and fats, as well other topics such as healthy snacking and physical activity. The second limitation relates to the research sample size, which consisted of preservice science teachers. Future research should include a larger sample size to increase statistical power and generalizability of the findings. This can include a larger sample of pre-service teachers, as well as in-service teachers and high school students who will benefit from learning about healthy nutrition.

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Declarations

Conflict of Interest The authors declare that they have no conflict of interest.

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