



# Development of creativity in physical education teachers using interactive technologies: involvement and collaboration

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## Abstract

The popularisation of an active lifestyle and sports is a hot topic today. The countries activate the interest of the population in physical culture introducing creative training activities in sports. The research highlights that it is important to develop creative thinking in physical education teachers. Thus, the main research goal is to analyse the influence of interactive technologies used to develop creativity among physical education teachers. The researchers use tablet computers with a video communication function for the experiment. All training sessions were conducted on the Zoom conferencing platform. The training took 6 months. The proposed training included power training, yoga, dance and gymnastics. At every third lesson, three respondents developed and presented their training programme for the rest of the group. *Torrens creative thinking test* was used to assess the results. The comparison of the training dynamics in men and women ( $P$ -value = 0.019 and 0.003, respectively ( $p \leq 0.05$ )) proves the effectiveness of the proposed training techniques. It means that this technique is effective for sports activities and can be introduced in educational institutions. The scholars recommend using it in schools, universities and other educational institutions.

**Keywords** Creative thinking · Interactive technologies · Multimedia education · Physical culture · Sports

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## 1 Introduction

The development of creative abilities is a vital issue for discussions and innovations. First of all, freedom of expression and creativity affects learning and decision-making in different spheres of life. Creative thinking facilitates the development of new techniques and findings (Zielińska et al., 2022). The development of such skills requires teachers to acquire relevant competences. Effective teaching methods affect the skills of students and freedom of thinking (Ayyildiz & Yilmaz, 2021). Physical education teachers are involved in a variety of activities daily. Interested training lessons have a positive impact on student's motivation. It supports the interest of the population in sports. It will help to improve the health conditions of the population in the future and facilitates general physical activities (Uzunöz & Demirhan, 2017). Therefore, the development of creativity among physical education teachers is important at the local and global levels (Engdahl et al., 2021). In pedagogical science, a few methods of professional development exist. The main methods of professional development are: lecture-based learning (listening to various lecture courses), self-study (obtaining knowledge from video tutorials and literature on your own), and interactive learning, during which teacher-student interaction takes place. Physical education teachers should review them regularly to improve their teaching skills (Patti et al., 2015). The analysis of the physical education methods and training approaches reveals that many methods can be considered by scholars. The most popular methods include different training activities explaining the physical training to health groups. Physical education teachers learn about different health groups and physical loads that can be given to students of a certain group. During such training sessions, teachers learn how to evaluate health groups (Mujika, 2017). Different physical education courses for teachers exist where they learn about different training programmes. In most cases, they include knowledge about all muscle groups and exercises for strengthening the muscles (Krzysztofik et al., 2019). They include gymnastics and yoga lessons (Richardson et al., 2019). Such training takes place in real-time. However, innovative technologies allow teachers to learn these practices online. This encourages the development of new teaching programmes as well as the use of a large arsenal for visualising learning materials (Palvia et al., 2018). At the moment, Internet resources provide users with unlimited space, thus every individual has access to learning programmes. The development of multimedia technologies such as computers, tablets and even mobile phones facilitate online learning. Different gadgets allow users to be online at any convenient time and place. Thanks to this approach, it is possible to gain knowledge from anywhere in the world. The discovery of such opportunities increases people's motivation for education (Goodrich, 2021). Many web-based applications are being developed for different purposes and teachers can conduct distance lessons and be engaged in self-education. Information technologies help teachers to exchange information and experience with colleagues and physical education teachers from other countries. The proposed method of communication is less costly and time-consuming. Also the exchange of information increases the level of progress in the field. These are the main advantages of multimedia teaching (Chandra & Palvia, 2021). The most

popular multimedia training for physical education teachers are lessons through video conferencing platforms. This is due to the possibility of real-time visualisation, which allows both demonstration of the exercises and control over their correct execution. Therefore, by far one of the most used applications has become Zoom.

Using the video camera, teachers can conduct different forms of online training. Participants take part in the training and can watch their images on a common screen (Krutka et al., 2019). Teachers can conduct lectures without videoconferencing (Correia et al., 2020). In addition to training, pre-selected videos are available on different multimedia platforms for self-study. This technique helps to consolidate the material and acquire more knowledge in a short period. Nowadays, this approach is usually used in the methodology both for students' independent work and for more in-depth study of the topic (Jung et al., 2019). The development of creativity based on such methods requires the analysis of teachers' skills and further areas of improvement for different training programmes and the development of the individual approach to their students.

The proposed approach will help to develop a creative training programme and increase the motivation for lessons among students (Livy et al., 2022). The teachers training on how to apply an individual approach to learning and foster creative thinking has been introduced. Before that, it was necessary to familiarise teachers with the learning framework and demonstrate the real capabilities of the proposed training programmes. Improvisation techniques are helpful in different types of lessons and help students to acquire the necessary skills. One of the possible methods is to ask a physical education teacher to design the training programme based on the acquired knowledge and skills (Hickey et al., 2016). Only a few methods are available for teachers to improve their qualifications and teaching methods. However, multimedia technologies make it easier to learn new methods, acquire new skills, find and collect information on a particular topic. This opens up many possibilities for improving and creating new pedagogical methods. A confirmation of these factors can be seen in the number of new developments in recent years. Therefore, information technologies have become very popular in recent years (Rho & Kang, 2019).

The use of Internet resources and gadgets for teaching and improving the creative skills of physical education teachers is a hot topic in education. After all, the creative elements in sports attract more individuals and motivate them to train. More and more individuals will follow healthy lifestyle patterns. But how this approach affects the creativity skills of physical education teachers is not yet fully known. This is because there is not much research in this area, as the possibility of moving to an online learning format and its popularisation has not happened for a long time.

## 1.1 Literature review

Researchers from the National Taiwan Normal University analysed the impact of virtual reality technology on the development of creativity. Using virtual reality as a teaching tool in schools, the scholars have made the following conclusion: the proposed strategy has a positive impact on creative design and influences the transition from the traditional learning experience to reflection and abstract understanding of

the given tasks. These qualities stimulate the development and application of innovations (Chang et al., 2020). Scientists from the University of Kafrelsheikh (Egypt) examined the role of multimedia technologies in the development of design skills and creativity. The experiment included students, where one group was taught using classical educational methods and the second group was taught using multimedia technologies. As a result, the second group achieved better results than the first one. The obtained results confirmed the advantages and illustrated the benefit of using gadgets and virtual reality to enhance students' creativity skills (Elfeky & Elbaly, 2021).

The scientists from the National Taiwan University of Science and Technology analysed the effectiveness of gadgets in physical education teaching. The results show that the number of educational materials on physical culture in multimedia format is increasing every year. Mobile technologies used in physical education help to acquire more knowledge and become more and more popular. The sports activities that can be taught effectively through multimedia resources are very limited. The main focus is on the development of dynamic sports. Therefore, the researchers discuss the limitations of teaching physical education using mobile applications (Yang et al., 2020). Researchers from Lishui University (China) investigated the impact of web platforms on the development of critical and strategic thinking in physical education. The sample included students from 18 to 35 years. Their task was to exercise regularly using a mobile application. As a result, the indicators of health outcomes, well-being, self-organisation, motivation and self-control increased among all respondents. The experiment helped all individuals to develop healthy eating habits and reduce fatigue (Qi, 2021).

The scholars of the University of Georgia (USA) investigated the outcomes of the integration of multimedia technologies in physical education. The scientists suppose that the proposed techniques are gaining popularity but they have not been developed yet. The researchers recommend providing teachers with more information about educational technologies. Not all educational institutions have the opportunity to purchase expensive equipment and have to initiate a *Bring your device* solution (Kim & Gurvitch, 2018). Researchers at Walailak University in Thailand examine the impact of physical activity on the creativity of young people. Nearly 1500 students took part in the experiment. A specialised programme of physical activity was developed for them including joint games, group sports, etc. Next, a specialised test for creativity helped to assess the skills of the respondents. The results showed that physical activity has an impact on thinking skills and the development of creativity (Piya-Amornphan et al., 2020). At the University of Alicante (Spain), the scholars examined the development of creative thinking in physical education students through body expression. The experiment was based on the analysis of body expression during lessons. The research used a specialised test for creative intelligence to evaluate the results. The intermediate testing showed that the best test results were found in women. However, by the end of the experiment, the indicators of creativity among the male and female participants were similar (Vidaci et al., 2021).

Researchers from Chengdu, Tangshan and Deyang (China) examined the relationship between the personal qualities of physical education teachers and the effectiveness of teaching. The results demonstrated that individual factors influence the teaching of

creative design. The qualities such as extraversionness, pliability and openness of the teacher affected the teaching innovativeness. The support of the educational institution plays a vital role in the creative development among teachers (Deng et al., 2020). Kent State University (USA) introduced a specialised method of online learning in physical education. The strategy consisted of the interaction of physical education teachers with their students using multimedia technologies. It included training activities, exchange of practices and communication between students. Using the results, the scientists concluded that the transition to online learning was not an inferior method to the traditional teaching model. Therefore, researchers recommend teachers change their learning style and use more modern and convenient technologies (Sato & Haegele, 2018). Scientists from San Jose State University (California, USA) explored the prospects for online education in physical culture and sports. The popularity of multimedia technologies in education is increasing rapidly because they become a major indicator of the successful acceptance of information. Opportunities for online education are expanding both locally and globally. The proposed approach helps to introduce new educational programmes for students (Daum et al., 2021; Grigorkevich et al., 2022).

Researchers from Deakin University (Australia) analysed the prospects of online learning in sports. Unlike most of their colleagues, the researchers admitted that some sports have not used online resources yet. Scientists underlined that online learning was ineffective for learning specific skills. These skills included throwing, catching, and running. However, researchers found that such problems could be solved by introducing new teaching methods and specialised programmes for teachers (Lander et al., 2022). The literature analysis helped the scholars to identify the following factors. First, online physical education programmes have a positive impact on the development of creativity. Second, the proposed training stimulates teachers to introduce new teaching methods. Third, the training helps the scholars to exchange experience with foreign colleagues without using a lot of resources. However, not all sports activities could be taught remotely, using multimedia technologies. New technologies ensure an opportunity for further research of sports activities online.

## 1.2 Setting goals

The research goal was to analyse the influence of interactive technologies on the development of the creative potential of physical education teachers. The options and scope of the online education methodology focused on physical education were researched. The research purpose was to examine the impact of multimedia technologies on the development of creativity, the prospects and progress of this learning environment. The experiment took place at Lishui University, Department of Physical Education, School of Teacher Education. The main research tasks were to integrate multimedia technologies into a group of teachers of physical education. Specialised testing for creative thinking was used to evaluate and summarise the results. The testing helped to understand the effectiveness of the proposed technique and assess the progress of the experiment. An analysis of the prospects of the interactive teaching methodology for the development of creative qualities in physical education teachers was made.

## 2 Methods and materials

### 2.1 Research design and sample

The scholars used randomised research to assess the impact of interactive technologies on the development of creative thinking among physical education teachers. The experiment was conducted at Lishui University, Department of Physical Education, School of Teacher Education. The sample involved 48 physical education teachers from 24 to 30 years (24 females and 24 males). The participants were randomly assigned to groups of twelve. It helped to acquire the material and learn the lessons. A specialised training and testing programme was developed for these groups.

### 2.2 Experiment

Before the experiment, all respondents passed a specialised *Torrens creative thinking test*. The test reveals the abilities to perform certain tasks, combine different sources of information and solve different problems creatively. The test consists of several blocks. In this experiment, only a part of this test, known as *The Torrens Tests of Creative Thinking*, was used. It included some tasks without time limits. The first task was to draw a picture based on an oval image of any colour. The participant could choose any colour he liked. At the end of the drawing, the participant had to name the picture. The second task was to finish the ten proposed drawings. As in the first stage, the participants had to name the drawings. The third test consisted of a finished stencil with thirty repeating vertical lines. In their intervals, it was necessary to draw as many non-repeating patterns as possible. The results were evaluated according to five criteria: fluency, originality, development, resistance to closure, and the abstractness of the names. *Fluency* helps to assess the creative productivity of the participants. *Originality* is used to evaluate the uniqueness of creative thinking. *Developments* mean the ability to pay attention to details. *The resistance to closure* reflects the ability to be open to new ideas. *The abstractness of the names* reflects the ability to understand the essence of the problem and highlight its main points. Each indicator was rated from 0 to 10 points. After the evaluation of the results, the data were summarised (Humble et al., 2018).

A professional psychologist assessed the tests. The test was sent by e-mail to the respondents. They passed the test either by printing out a form with tasks or by completing a task using a graphic editor. The participants sent the test results by mail to a specialist who evaluated them. Such testing was carried out several times during the experiment. The research took 6 months. The lessons were conducted by teachers of physical culture and sports. The aim of the training was to conduct lessons 3 times a week for 3 h each with the four groups. The lessons were held remotely using tablet computers with the possibility of video broadcasting (Krause et al., 2018). Before the experiment, each participant received such a tablet by mail. For the broadcast, the Zoom application was used. The virtual classrooms were formed for the research (Powell et al., 2021). At a certain time, the respondents and the teacher joined the

online lessons. The participants had to join the online video broadcast of the lessons. The lessons included different types of training such as power training, yoga, gymnastics and dance (Govindaraj et al., 2016; Kerr et al., 2019; Schupp, 2017). The last session of each week was improvisation. In turn, three students had to demonstrate their training programme prepared for the lesson. At the next improvisation lesson, another three of the respondents demonstrated their talents. The improvisation part was not critically evaluated.

### 2.3 Statistical processing and data analysis

A specialised software package for statistical analysis SPSS 26.0 was used to process and calculate the data. The interpretation of the final results was carried out using Microsoft Excel 2019. The Student's t-test helped to compare the effectiveness of the proposed teaching approach in groups and the impact of sex on the overall research result. The Student's t-test assessed the initial training level as the average pre-test result in both control groups. The post-test scores were compared and the research identified the difference between the groups. The statistically significant test level was set ( $p \leq 0.05$ ). For median analysis, 95% confidence intervals (CI) were calculated. The validity of the Student's t-test was assessed by comparing the results with the null hypothesis. The null hypothesis in this study was a test for statistical normality. If the null hypothesis was rejected, then an alternative hypothesis was accepted, which indicated a difference in the results between the groups. Pearson's test was used to measure statistical normality. For clarity, it is presented as a comparison between the overall pre-test and post-test results of both groups.

### 2.4 The research restrictions

The main research objective is to develop creative thinking among physical education teachers. The research is randomised and the initial development or lack of creativity is not taken into account. All calculations represent the arithmetic average of the sample. It does not give a complete understanding of how creative thinking develops in an individual using this teaching method. Additional research is required to analyse this aspect. Another nuance of the research is the duration of the effect of this technique since the final testing was not carried out. Further research is needed to investigate this issue.

### 2.5 Ethical issues

Before the experiment, all participants were informed about the goals of the research, the structure and time. The respondents were informed about the control tests. The respondents received all information in the electronic form to their e-mails, when applying for participation in the experiment. Further, their consent was received in a detailed form by e-mail.



### 3 Results

Before the research, the scholars tested the creative thinking skills of all participants using *Torrance Tests of Creative Thinking*. The test identified the initial level of creativity among the participants. The students were divided into groups by sex to better understand the development of creative potential in males and females. The final result had an average value in each group. The results were evaluated using the 10-point scale. The independent Student's criterion helped to calculate and compare the results of the two groups.

In the groups, the average values of *Fluency* for males and females were  $5 \pm 0.816$  and  $4.25 \pm 0.5$ , respectively. The significance level of indicators (*P*-value) was 0.178 ( $p \leq 0.05$ ). It showed the results for the researched criterion. The scholars analysed the similarity of the results in both groups. *Originality* in both groups was  $4.5 \pm 0.577$ . The significance level was equal to 1 ( $p \leq 0.05$ ). The results for this factor in males and females did not differ. *Developments* in the male and female groups were  $4.5 \pm 0.577$  and  $3.5 \pm 0.577$ , respectively. The significance level (*P*-value) was 0.05 ( $p \leq 0.05$ ). According to this criterion, the result in male participants was statistically higher than in females. The values of the *Resistance to Closure* of the male and female participants were  $4 \pm 0.816$  and  $5 \pm 0.816$ , respectively. The results were not statistically significant. *P*-value was 0.134. In the groups, the difference was not statistically important. *The abstractness of the names* in the groups of males and females was equal to  $3.5 \pm 0.577$  and  $4.5 \pm 0.577$ , respectively. The significance level for this criterion was 0.05 ( $p \leq 0.05$ ). It showed a significant difference between males and females for this criterion. The female participants showed higher results than the male participants. The final result in the control groups was  $21.5 \pm 30.406$ . *P*-value was 0.01. The null hypothesis was confirmed. The final results in the groups were identical. All data are shown in Table 1.

After the experiment, the final test to assess the critical thinking skills was made. The results of the final test showed no significant differences in the groups of males and females ( $7 \pm 0.816$ ) and ( $6.5 \pm 0.577$ ), respectively. The *P*-value was 0.36 ( $p \leq 0.05$ ). The results for this criterion in males and women were not statistically different. *Originality* in both groups was ( $7.5 \pm 0.577$ ). The significance level was 1 ( $p \leq 0.05$ ). For this factor, statistical differences were not identified. The *Developments* criterion in the male group was  $7.5 \pm 0.577$ , and in the female

**Table 1** Pre-testing results

Scales names	Average value in the male group	Average value in the female group	Significance level ( <i>P</i> -value)
Fluency	$5 \pm 0.816$	$4.25 \pm 0.5$	0.178
Originality	$4.5 \pm 0.577$	$4.5 \pm 0.577$	1
Developments	$4.5 \pm 0.577$	$3.5 \pm 0.577$	0.05*
The resistance to closure	$4 \pm 0.816$	$5 \pm 0.816$	0.134
The abstractness of the names	$3.5 \pm 0.577$	$4.5 \pm 0.577$	0.05*
Total	$21.5 \pm 30.406$	$21.5 \pm 30.406$	1

\* $p < 0.05$



group was  $6 \pm 0.816$ . P-value was 0.027 ( $p \leq 0.05$ ). It showed the statistical significance of the results. The results for this criterion were higher for the male participants than for the female participants. The *Resistance to closure* in men and women was ( $6.5 \pm 0.577$ ) and ( $8 \pm 0.816$ ), respectively. The significance level was 0.027 ( $p \leq 0.05$ ) and it had a statistical significance. In this case, the level of resistance to closure was higher in women than in men. *The abstractness of the names* in both groups was equal to ( $6.5 \pm 0.577$ ). P-value was 1 ( $p \leq 0.05$ ). According to this criterion, no differences were found among men and women groups. The final result in the group of men was ( $35 \pm 0.816$ ), and in the group of women ( $34.5 \pm 0.577$ ). The scholars underlined that the data were similar statistically. The results are presented in Table 2.

The Student's criterion helped to evaluate the effectiveness of the technique. The preliminary and final tests of the male and female groups were compared. P-value for the male group was 0.019 ( $p \leq 0.05$ ). It suggested that the results had statistically significant differences. In women, P-value was 0.003 ( $p \leq 0.05$ ). This result also indicated significant differences between the preliminary and final tests. Also in this comparison, Pearson's test was applied to test statistical normality. When comparing both groups, the coefficient on this parameter was 1 ( $p \leq 0.05$ ). This demonstrates a perfect positive correlation. The differences in the dynamics were identified and the scholars proved the effectiveness of the technique. The results are presented in Table 3.

The scholars state that the proposed interactive learning methodology is effective for the development of creativity among physical education teachers. The research participants admit an increase in motivation to work during the current research. However, it should be taken into account that the experiment was randomised and it did not show the absolute accuracy of the results. Further research is required to clarify the results in specific areas.

**Table 2** Final testing

Scales names	Average value in the male group	Average value in the female group	Significance level (P-value)
Fluency	$7 \pm 0.816$	$6.5 \pm 0.577$	0.36
Originality	$7.5 \pm 0.577$	$7.5 \pm 0.577$	1
Developments	$7.5 \pm 0.577$	$6 \pm 0.816$	0.027*
Resistance to closure	$6.5 \pm 0.577$	$8 \pm 0.816$	0.027*
Abstractiveness of the names	$6.5 \pm 0.577$	$6.5 \pm 0.577$	1
Total	$35 \pm 0.816$	$34.5 \pm 0.577$	0.36

\* $p < 0.05$

**Table 3** Assessment of the programme effectiveness

Scales names	Average value of the preliminary testing	Average value of the final testing	Pearson's test	Significance level (P-value)
Final results (males)	21.5 ± 0.707	35 ± 1.414	1	0.019*
Final results (females)	21.5 ± 0.707	34.5 ± 0.707	1	0.003**

\* $p < 0.05$ 

## 4 Discussion

Researchers from Australia have been analysed distance learning in dance education and its impact on the individual's cognitive functions. The experiment involved participants from Australia and the UK. The interactive technologies helped the respondents to learn the art of dance. They connected to a common network using a specialised application and watched video broadcasting to learn the elements of choreography. At the end of the experiment, the proposed teaching method increases the physical, cognitive and creative potential of students (Huddy et al., 2021). The comparison of the two tests allows the scholars to conclude that the use of interactive technologies in teaching sports disciplines affects the development of creative thinking. The researchers from Australia identified the influence of dance on the development of creative thinking.

In the UK, researchers analysed the experience of using mobile technology to increase student learning and interest in dance. The scholars introduced a specialised methodology for teaching choreography based on a mobile application. The sample involved 42 respondents. They were taught to dance using interactive technologies. The researchers admitted that interactive technologies supported the expansion of different physical activities and facilitate the development of a more democratic environment. The integration of multimedia technologies in the educational process has improved the learning and motivated the participants to acquire knowledge and skills (Alexander et al., 2021). Scientists from the UK, similar to the present research, found that interactive technologies in teaching sports were important for the overall success of the training programmes. Both pieces of research concluded that participants were more motivated and engaged using multimedia technologies. The main difference between the experiments was in their goals. Researchers from the UK focused on improving the learning process, while the present research analysed the impact of multimedia technologies on the creative abilities of respondents. Scientists from the University of Melbourne (Australia) examined creative interpretations of physical education programmes. The researchers found that additional training was required to introduce new methods in sports and physical education.

The process of developing and integrating a strategy requires additional efforts for interpretation and adaptation. Teachers must be prepared for the additional workload to work effectively with these strategies. The experiment involved teachers from Finland, who used the methods of their Australian colleagues in their teaching practice. The

results showed improvements in creative thinking skills in the teaching staff and students. The interest in physical culture by students was also identified (Quay et al., 2016). The research by scientists from Melbourne has the same methodology as the present one. Both experiments analysed the impact of new strategies on the development of creativity in sports. The main difference was the absence of integration of multimedia technologies to learning. Tarbiat Modares University (Iran) examined the impact of advanced multimedia software on the improvements of physical activity. The main health-related problem of the target population was a sedentary lifestyle that prevailed among the female population. An emphasis was on the importance of physical activity for health issues. The research was randomised. The research purpose was to analyse the impact of multimedia technologies on fitness and health. All respondents received an electronic media with the training video. According to the results, all participants of the experiment improved their physical fitness (Gholamnia-Shirvani et al., 2018). The similarity of the research is that Iranian scientists have proven the positive impact of the proposed solution on motivation and the effectiveness of multimedia technologies in physical training. The research discusses the importance of physical culture and its impact on health. However, the main difference between the experiments is the purpose of the research. The Iranian scientists examined the improvements in the physical fitness of the population. In this experiment, the scholars concentrated on the development of creative thinking. The scientists from Deakin University (Australia) investigated the possibility of maintaining physical activity using interactive technologies. They examined the role of digital platforms and their application under the COVID-19 pandemic restrictions. The research found that many applications have already been introduced to ensure physical fitness and allowed individuals to maintain an active lifestyle. Ready-made sports platforms with specific exercises are available for the population and video conferencing applications can also be used to conduct physical education lessons. Scientists suppose that such applications help individuals maintain an active lifestyle and popularise sports (Parker et al., 2021). A study by Australian researchers demonstrates the flexibility of interactive technologies in physical education and the promotion of active lifestyles among young people and adults. This study differs from the present study. However, it discusses the benefits of interactive education for physical activity and sport. The aforementioned information allows researchers to conclude that the integration of multimedia technology enhances creativity and shows itself as an effective method in sport. It is worth bearing in mind that not all of the works presented above specifically address the development of creative thinking with the help of this technique. Most research papers on this topic focus on the effectiveness of sport or motivation. Also, this article looks at the development of creativity among groups of people divided by gender. This gives an insight into which creative thinking criteria development is more typical for men and for women. Nevertheless, there are some limitations. First, not all sports can be analysed using interactive technologies. Secondly, most experiments are randomised, and it is not possible to study the effect of a fitness coach or a specific problem on fitness outcomes. Further research is needed to investigate this issue. Based on these limitations, further experiments in this area can be conducted. The proposed recommendations are intended for educators. They may also be of interest to the general population in the context of introducing such methodology as specialised courses and trainings.

## 5 Conclusion

The integration of multimedia technologies has a positive impact on the development of creative thinking among physical education teachers. The research results prove the effectiveness of the proposed strategy for sports. *The fluency* factor for the male and female groups did not show significant differences. *Originality* in the groups also did not differ greatly in the preliminary and final test results. *The developments* criterion for the male participants was higher than for females at both stages of the experiment. The results of *the resistance to closure* in the preliminary test and the final test were equal. However, at the final test, this factor in women was statistically higher than in men. *The abstractness of the names* in women was higher at the preliminary stage. The final test showed similar results in both groups. A comparison of both groups shows indistinguishable results of the experiment in men and women. The results for dynamics show significant statistical differences. The practical value of this research is that the new teaching methodology based on interactive technologies should be introduced in physical education. The uniqueness of the methodology is that it positively influences the development of creative thinking in individuals. Therefore, this strategy can be effectively used in schools, universities and other educational institutions. The integration of multimedia technologies in physical culture popularises an active lifestyle among the population. Various sports organizations can implement training courses using interactive technologies to attract more customers. This methodology can also be used for the exchange of experience between different countries. The theoretical uniqueness of the study lies in the comparison of the impact of the described methodology on different gender groups. This demonstrates the difference in both the impact and the perception of this pedagogical strategy. However, educators should bear in mind that the research is randomised and all calculations are of the average value, thus some inaccuracies may exist. There is no data available on how this technique can affect the development of the creative thinking of a particular individual. Further research is needed to analyse this problem. The present research paves the way for new research in this area.

**Authors' contribution** All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Zhou Xing, and Yue Qi. The first draft of the manuscript was written by Yue Qi and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

**Data availability** Data will be available on request.

## Declarations

**Consent** All participants gave their written informed consent.

**Ethics approval** The authors declare that the work is written with due consideration of ethical standards. The study was conducted in accordance with the ethical principles approved by the Ethics Committee of Lishui University.

**Competing interests** The authors have no competing interests to declare that are relevant to the content of this article.

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