Using Active Learning to Develop the Problem-Solving Ability of Chinese College Students Majoring in Physical Education

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Abstract

The aim of this study was to research designing an active learning physical course that can improve the problem-solving ability of college students majoring in physical education. The study applied a quasi-experimental design, and the participants were 60 Chinese college students. The experimental class consisted of 30 students subjected to active learning methods for 8 weeks, totalling 32 class hours; the control class without intervention consisted of the other 30 students. The Problem Solving Inventory was applied to the pre- and post-tests. The result showed that the problem-solving ability of college students majoring in physical education significantly improved in the experimental class after the treatment.

Keywords: active learning, physical education curriculum, Chinese universities, college students majoring in physical education, problem-solving ability

1. Research Background

Physical education has become the main means of improving adolescents' physical and mental health to achieve the mission of a "Healthy China." Therefore, adapting the physical education curriculum to meet this requirement is a new challenge for sports workers (Wahlström, 2022). As a result, those involved in physical education in colleges and universities are actively learning advanced physical education teaching and management (Paul & Lord, 2021) and strengthening the improvement and management of the physical education model (Maksymchuk et al., 2018). However, in the actual teaching process, the teaching leaders, the main bodies of teaching, and the educational resources are often "separated" through the effect of the behaviourist theory of teaching and the traditional Chinese education system, as well as the particularity of the physical education major itself and the personalities of students majoring in physical education (Catalano & Catalano, 1999). Chinese teaching methods such as listening and demonstration (Younis, 2021) restrict students' ability to self-learn and cooperate in a group. This is incompatible with the problem-solving and inquiry-based teaching methods used in the education systems of the West (Häkkinen et al., 2017).

To change this situation, Chinese educators have adopted new teaching modes such as "flipped classrooms" and "project-based learning (PBL)," both of which involve a process of iterative questioning, communicating, thinking, and sharing that enables students to construct knowledge and create meaning (Katić, 2008). They also succeed in encouraging students to actively participate in classroom learning, guiding them to learn, improving their self-study and self-practice ability, enabling them to discover nature and the world in an active learning way, solving problems in exploration (Cooper et al., 2018), and gaining a sense of achievement and satisfaction in solving special technical problems. These methods, widely referred to as "active learning," are used by colleges and universities that have

begun to pay more attention to improving students' ability to learn, innovate, and solve problems (Rönnlund et al., 2021). According to Huang et al. (2020), improving students' problem-solving skills should be an important issue for educators. Teaching no longer entails simply instilling knowledge in students but engaging them in learning (Åkerlind, 2004).

The educational and teaching concept of centralizing students' development and paying full attention to their needs and interests in the physical education curriculum has again been clearly emphasized (Tsangaridou & O 'Sullivan, 2003). This is also the core concept of higher education in the future (Benlahcene et al., 2020). According to Charles (2014), teaching methods and curricula must shift to a paradigm emphasizing critical thinking and problem-solving skills. Lee and Hannafin (2016) have also supported student-centred learning to encourage students to participate in meaningful learning and reflect on their progress by discovering and constructing their own knowledge. Students who actively participate in learning will learn more than those who are instructed passively (Deslauriers et al., 2019); those who actively participate in active learning and student-centred learning will have better problem-solving and critical thinking skills. The aim of this paper is to produce an active learning physical education curriculum for Chinese universities to improve the problem-solving ability of physical education majors and promote their all-around development to meet the needs of modern society (Jin, 2013). At the same time, two research problems will be solved. The first is how to implemen an active learning physical education curriculum in Chinese universities and colleges, and the second is how to improve the problem-solving ability of college students majoring in physical education based on an active learning physical education curriculum.

2. Literature Review

2.1 Active Learning

"Active learning" became implemen in classroom teaching in Western universities in the 1990s. Jesionkowska et al. (2020) explained that active learning can best be achieved through team cooperative learning and project inquiry learning, which imply the characteristics of active learning. This type of learning conforms to the principle of constructivism and entails a mixture of cognition, meta-cognition, evolution, and emotion (Kroll, 2004). Some researchers have argued that teachers play a more subtle role in active learning situations by indirectly cultivating and promoting learners' learning (Bellet & Kozlowski, 2008). The core element of active learning is to let students actively participate in classroom activities. Students should not only be encouraged to study enthusiastically but should also learn to reasonably manage their classroom learning behaviour (Prince, 2004). Some scholars have argued that active learning can reduce students' failure rate: the scores of students in classes in which active learning and interactive participation technology are used are higher than in traditional classes (Freeman et al., 2014). Vekkaila and Pyhältö (2016) found that active learning was important in the learning process of doctoral students in the natural sciences. In this study, active learning is defined as a teaching activity and teachers play a guiding role. Various forms of guidance can be used to maximize students' subjective initiative during the whole teaching activity, and students can use their prior knowledge and skills to participate in and complete the learning activities.

Many researchers have shown that active learning is effective; it is also in line with the "student-centred" concept of higher education in China based on its widely recognized advantages (Umbach & Wawrzynski, 2005). Anderson et al. (2000) suggested that sports are a field in which learning, thinking, and activity can complement each other. Active learning is far more meaningful than hands-on activities, class involvement, or having students walk around the classroom (Varea & González-Calvo, 2021). Camiré et al. (2009) asserted that the abilities and initiative of young athletes should be valued. Therefore, applying active learning to the physical education curriculum of Chinese colleges and universities will help teachers correctly connect their students' sports skills to the appropriate theory and thus improve their key physical education competencies (Lleixa et al., 2016). The sports process can enrich students' experience and help them internalize sports knowledge (Allen et al., 2010). On this basis, it is essential to actively explore the innovative integration of active learning in college and university physical education courses to compensate for the lack of problem-solving training for college students majoring in physical education and effectively improve the teaching effect.

2.2 Problem-Solving Ability

Obstacles preventing individuals from achieving their goals are called problems (Mitchell et al., 2021). Problem solving is a process everyone learns at school and experiences daily (Chitpin & Evers, 2005). El Zein and Hedemann (2016) have informed students that problem-solving is a learning outcome that will differentiate them from other students and help them find the job they want and contribute to society. According to Rahman (2019), problem solving is a process in which people use their prior knowledge and experience to solve problems by employing a series of thinking activities, methods, and strategies based on a goal-oriented psychological process. Therefore,

students should be taught any knowledge, skills, and attitudes to support and promote their involvement in a participatory problem-solving process that supplements their problem-solving skills (Vidal, 2009). Problem-solving ability is defined in this study as students' level of thinking and ability to overcome difficulties and solve problems based on the use of their own knowledge, principles, and scientific thinking methods in the process of learning and the evaluation of relevant content.

Coalter (2010) observed that the ability to solve problems is very important in sports. The knowledge acquired from physical education and training can make it easier and faster for individuals to pass the problem-solving stage, and athletes are more likely to discover solutions to problems. Smithe and Zhu (2011) proposed that sport, like all other learning fields, should encourage students to think independently and creatively and use their problem-solving skills to achieve their educational goals. Nopembri et al. (2019) found that students can effectively improve their ability to cope with stress and solve problems in physical exercise by participating in activities that need critical thinking, inquiry, and cooperation with others. According to Görücü and Cantav (2017), problem solving is one of the most basic skills that physical education majors and students in sports colleges and universities should master, and the ability to solve problems is considered an important factor for athletes' success. Although some problems have clear solutions or correct answers, others do not, and solving them requires interdisciplinary knowledge, comprehensive thinking, and creativity (Steiner & Posch, 2006). Therefore, this study involves researching an active learning physical education curriculum to improve physical education majors' ability to solve problems.

3. Methodology

The purpose of this study is to produce a physical education curriculum based on active learning to enhance the problem-solving ability of physical education majors in Chinese colleges and universities. This will involve integrating the three core concepts of "discussion", "practice", and "teaching others" in the Cone of Learning and the "analysis", "evaluation" and "creation" of Bloom's educational classification into the content of a specific basketball course, as well as undertaking a quasi-experimental study to determine if a physical education curriculum based on active learning can improve the problem-solving ability of college and university students.

3.1 Participants

Sixty college students majoring in physical education at a university in Zhejiang Province, China, participated in this study. They were evenly divided into two classes at random, with 30 students in one class serving as the experimental class (EC) engaged in active learning. The remaining 30 students who served as the control class (CC) received no intervention. Only one teacher was selected to teach both classes to minimize the interference of teacher variables in teaching and develop the curriculum established in this study.

3.2 Research Procedures

The study was divided into two stages to achieve the research purpose. The first stage was the construction of the active learning physical education curriculum. Figure 1 shows Earley's (2007) path of curriculum construction, based on mixed research methods. The second stage was an experimental study. According to Erlingsson and Brysiewicz (2013), this type of design can facilitate comparing the test results of two groups so that the researcher can understand the overall effectiveness of the active learning intervention.

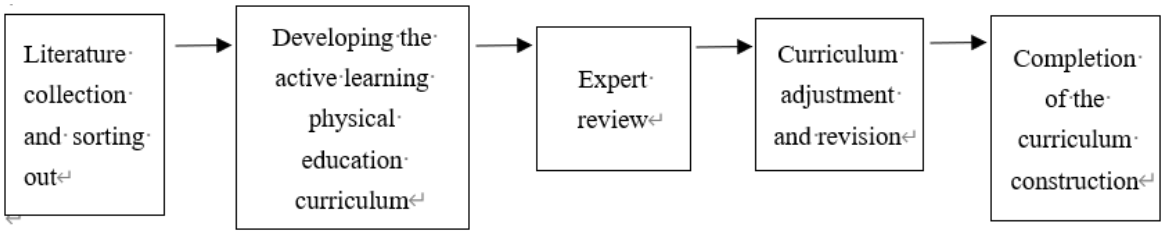

Figure 1. Establishing Active Learning Physical Education Curriculum in Chinese Colleges and Universities

Note: Developed for this study

3.3 Intervention of the Study

The aim of this experiment was to improve the problem-solving ability of college students majoring in physical education at a public university in Zhejiang Province, China. The experimental group's active learning physical education course consisted of six units, lasting for 8 weeks, with two weekly lessons, totalling 32 class hours. The textbook, Ball Games – Basketball (3rd edition), includes learning objectives from the ability to perceive motor skill problems in the first week to the ability to coordinate various basketball problems in the eighth week (see Table 1 for

details). In contrast, the control group received no intervention except for the traditional specific course teaching with the same teaching materials. Active control intervention was adopted to achieve the teaching effect, and the control group undertook the physical education course in a homogeneous teaching setting (Chen et al., 2017).

Table 1. Teaching Design of the Active Learning Physical Education Curriculum

Themes	Unit names	Learning targets	Teaching methods	Teaching activities	Evaluation methods
Unit 1 Breakthrough techniques	Lesson 1: Study of various breakthrough movements Lesson 2: Application of various movements in competitions.	The ability to perceive movements and skills problems	Lecture+audio-visual teaching+demonstration: provide special examples and explain specific knowledge	Teachers' demonstration and students' imitation exercises	Process evaluation, Summative assessment
Unit 2 Psychological training	Lesson 3: Attention training Lesson 4: Self-suggestion and relaxation training	The ability to anticipate psychological barriers	Lecture+audio-visual teaching+demonstration: provide special examples and explain specific knowledge	Teacher's explanation	Diagnostic assessment, Summative assessment
Unit 3 Tactical training	Lesson 5: Tactical training Lesson 6: Tactical training methods	The ability to avoid tactical problems	Lecture+demonstration: let students understand all kinds of tactical training.	Teachers' demonstration and students' imitation exercises	Process evaluation, Summative assessment
Unit 4 Mid-term test	Lesson 7: Review the contents of the first three units. Class 8: Use what has been learned in the first three units to have a three-on-three competition	The ability to coordinate various basketball problems	Discussion+practice: teaching competition in groups. Teach others:	Teacher's explanation and competition	Process evaluation, Summative assessment
Unit 5 Sports event	Lesson 9: Planning of Sports Events Lesson 10: Management of Sports Events	The ability to deal with sports events crisis	Discussion+practice: teaching competition in groups.	Teacher's explanation and competitions	Process evaluation, Summative assessment
Unit 6 Comprehensive training	Lesson 11: Physical training Lesson 12: Special training	The ability to face practical problems in sports training	Lecture+audio-visual+ demonstration: provide special examples and explain special knowledge. Practice: Try to use special knowledge to organize training activities.	Simultaneous interaction between teaching and learning	Process evaluation, Summative assessment
Unit 7 Skills control	Lesson 13: Basic skills practice Lesson 14: Basketball awareness practice	The ability to control motor skill problems	Discussion+practice: Group teaching Competition. Acquire, and teach others: Group students Demonstrate various skills.	Teachers' demonstration and students' imitation exercises	Process evaluation, Summative assessment
Unit 8 Final test	Lessons 15 and 16: Specific test	The ability to coordinate various basketball problems	Discussion+practice: Group teaching Competition. Acquire, and teach others: Group students Demonstrate various skills.	Competitions	Process evaluation, Summative assessment

3.4 Measurement of Pretest and Post-Test

A pretest and a post-test were conducted before and after the research treatment. The Problem Solving Inventory (PSI), developed by Heppner et al. (1997) and adapted into Chinese by Chen et al. (2010), was used in this study as the pretest and the post-test. The reliability and validity of the PSI have been widely tested in many aspects (Kourmousi, 2016). In this study, the PSI was adjusted for physical education majors based on the characteristics of physical education. There are six dimensions and 29 items in the PSI: namely, the ability to perceive problems with motor skills (seven items), the ability to anticipate problems with psychological barriers (four items), the ability to deal with an online public opinion crisis in sporting events (three items), the ability to face problems in sports training practice (three items), the ability to control sports technical problems (five items) and the ability to avoid tactical problems (three items). The PSI in this study was based on a 6-point Likert scale, with scores ranging from "strongly agree = 1" to "strongly disagree = 6" (Heppner & Petersen, 1982), and items containing both positive and negative statements. The lowest score on the PSI was 29, and the highest score was 174. A score below 80 indicated a high level of self-perceived problem-solving ability, and a score above 81 indicated a low level of self-perceived problem-solving ability.

4. Results

Sixty EC and CC students took the pretest and post-test of problem-solving ability. There were 23 boys and seven girls in the EC and 22 boys and eight girls in the CC. The post-test results showed that there was no significant difference in gender in the EC ($t=-1.846$, $p=0.075>0.05$) and CC ($t=-1.486$, $p=0.148>0.05$), which indicated that the different teaching methods had made no difference to the problem-solving ability of these male and female students.

4.1 Independent Sample t-test of EC and CC Students as a Pretest

An independent sample t-test was used to analyze the data before the experiment to determine if there were any difference in the problem-solving ability of the EC and CC students. As can be seen from Table 2, the pretest mean value of the six dimensions, including perceiving movement or skills, anticipating psychological barriers, and avoiding tactical problems in the control group, was between 3.36 and 4.33, and the standard deviation was between 0.62 and 1.11. In the EC, the pretest mean value of the six dimensions ranged from 3.09 to 4.29, and the standard deviation ranged from 0.43 to 1.35. The T values of the six dimensions ranged from 0.194 to 1.606, $p > 0.05$. This indicated no significant difference between the problem-solving ability of the EC and the CC before the intervention of the active learning physical education curriculum; hence, the requirement of homogeneity was met in the pretest.

Table 2. Pretest Results of Independent Sample t-test of Students in the Experimental and Control Groups

Dimensions	Groups	N	M	SD	t	Sig.
Perceiving movements or skills	EC	30	3.97	0.43	-0.655	0.515
	CC	30	4.06	0.62		
Anticipating psychological barriers	EC	30	4.01	0.76	-0.351	0.727
	CC	30	4.08	0.71		
Dealing with sports events crises	EC	30	4.00	0.49	-0.194	0.846
	CC	30	4.03	0.64		
Facing the practice of sports training	EC	30	4.29	1.09	-0.573	0.569
	CC	30	4.33	0.84		
Controlling movement techniques	EC	30	3.09	0.64	-1.606	0.114
	CC	30	3.36	0.67		
Tactical problems avoidance	EC	30	3.84	1.35	-0.974	0.334
	CC	30	4.16	1.11		
Total	EC	30	3.85	0.31	-1.264	0.212
	CC	30	3.98	0.48		

4.2 t-test of Paired Samples

A paired sample t-test was used to analyze the data to better determine if there were a statistically significant difference between the problem-solving ability of the EC and the CC of college students majoring in physical

education before and after the intervention of active learning in the physical education course. Table 3 shows that the EC students' problem-solving ability significantly improved in six dimensions, including perceiving movement or skills, anticipating psychological barriers, and coping with sports events crises ($p<.001$). This shows that the active learning physical education curriculum was very effective in improving the problem-solving ability of college students majoring in physical education, and the scores of students in the EC after the test were significantly higher than those before the test. In contrast, there was no significant difference between the CC students' scores before and after the test ($p > 0.05$), which proves that the traditional teaching methods do not help college students to improve their problem-solving ability.

Table 3. Paired sample t-test for each dimension of problem-solving ability

Dimensions	Groups	M	SD	t	df	p
Perceiving movements or skills	EC	1.15	0.60	10.60	29.00	0.00
	CC	-0.07	0.88	-0.42	29.00	0.68
Anticipating psychological barriers	EC	1.71	0.97	9.70	29.00	0.00
	CC	-0.25	1.06	-1.29	29.00	0.21
Dealing with sports events crises	EC	1.14	0.68	9.26	29.00	0.00
	CC	-0.03	0.80	-0.23	29.00	0.82
Facing the practice of sports training	EC	1.06	1.34	4.31	29.00	0.00
	CC	-0.17	1.11	-0.82	29.00	0.42
Controlling movement techniques	EC	1.23	0.78	8.61	29.00	0.00
	CC	0.33	1.20	1.49	29.00	0.15
Tactical problems avoidance	EC	1.72	1.70	5.54	29.00	0.00
	CC	0.24	1.51	0.89	29.00	0.38
Total	EC	1.29	0.35	20.12	29.00	0.00
	C	0.01	0.63	0.05	29.00	0.96

4.3 Covariance Analysis

A one-way ANCOVA method was used in this study if the problem-solving ability of the EC and the CC had reached a significant level in the post-test. The problem-solving ability of the two groups in the pretest was used as a covariant (control variable), the problem-solving ability of the post-test as a dependent variable, and the number of groups as a fixed factor in this analysis. Before undertaking the one-way ANCOVA analysis, it was necessary to check if the regression coefficients within the group conformed to the homogeneity hypothesis. Table 4 shows that the homogeneity of the regression coefficients within the group in the initial test indicated no significant difference between the EC and CC. The results of the initial test, perceiving movement or skills ($F = 0.15$, $p = 0.70 > 0.05$), anticipating psychological barriers ($F = 0.00$, $p = 0.95 > 0.05$), coping with sports events crises ($F = 0.51$, $p = 0.48 > 0.05$), controlling sports techniques ($F = 0.15$, $p = 0.70 > 0.05$) and tactical problems avoidance ($F = 2.88$, $p = 0.10 > 0.05$) showed that, after the control of the pretest, there was no significant effect on the two classes in the post-test.

The results of the covariate analysis showed that the problem-solving ability of both groups of students had been significantly affected, namely, perceiving movement or skills [$F(1,57) = 105.03$, $p = 0.00<0.01$], anticipating psychological barriers [$F(1,57) = 148.58$, $p = 0.00<0.01$], coping with sports events crises [$F(1, 57) = 81.53$, $p = 0.00 < 0.01$], facing the practice of sports training [$F(1,57) = 44.03$, $p = 0.00 < 0.01$], controlling sports techniques [$F(1,57) = 44.92$, $p = 0.00 < 0.01$], and tactical problems avoidance [$F(1, 57) = 31.33$, $p = 0.00 < 0.01$], indicating that the post-test scores of the students in the EC were significantly higher than those of the students in the CC. Therefore, applying the active learning physical education curriculum successfully improved the problem-solving ability of the students in the EC compared to those in the CC.

In summary, the one-way ANCOVA method was used in this study to analyze the statistically significant different problem-solving abilities of college students majoring in physical education. There were significant differences in the two groups' problem-solving abilities, and the scores of the EC were higher than those of the CC. Therefore, the problem-solving ability of the EC was stronger than that of the CC after the intervention.

Table 4. Analysis of One-way ANCOVA of Problem-Solving Ability

Dimensions	Sources	SS	df	MS	F	p
Perceiving movements or skills	Covariate	0.06	1.00	0.06	0.25	0.62
	Group	25.75	1.00	25.75	105.03	0.00
	Error	13.98	57.00	0.25		
Anticipating psychological barriers	Covariate	0.16	1.00	0.16	0.39	0.54
	Group	61.67	1.00	61.67	148.58	0.00
	Error	23.66	57.00	0.42		
Dealing with sports events crises	Covariate	0.06	1.00	0.06	0.24	0.63
	Group	21.70	1.00	21.70	81.53	0.00
	Error	15.17	57.00	0.27		
Facing the practice of sports training	Covariate	0.04	1.00	0.04	0.07	0.80
	Group	27.70	1.00	27.70	44.03	0.00
	Error	35.86	57.00	0.63		
Controlling movement techniques	Covariate	0.49	1.00	0.49	1.02	0.32
	Group	21.30	1.00	21.30	44.92	0.00
	Error	27.04	57.00	0.47		
Tactical problems avoidance	Covariate	1.33	1.00	1.33	0.92	0.34
	Group	45.24	1.00	45.24	31.33	0.00
	Error	82.32	57.00	1.44		
Total	Covariate	0.15	1.00	0.15	1.10	0.30
	Group	30.94	1.00	30.94	224.41	0.00
	Error	7.86	57.00	0.14		

5. Discussion

This study explored the effect of an active learning physical education curriculum on cultivating college students' problem-solving abilities. A quasi-experimental design was used to verify the learning effect after constructing the curriculum, thereby achieving the research purpose. The experimental results showed that active learning in the physical education curriculum could improve the problem-solving ability of college students majoring in physical education in China. These results are consistent with those of previous researchers; for example, adopting active learning can improve students' problem-solving ability in the EC (Görücü, 2016), and the effective teaching of active learning can improve students' ability to learn, understand and solve problems (Deslauriers et al., 2019). Häkkinen et al. (2017) also found that active learning enhances students' basic knowledge and problem-solving ability. Cheng et al. (2019) experimented on a course and found that students' problem-solving ability significantly improved due to active learning.

Another purpose of the study was to determine if the problem-solving ability of college students who take the initiative to learn physical education courses differs from that of students who do not. It was found that the problem-solving ability of college students had greatly improved after the active learning intervention, but there was no difference between the genders, which is consistent with the research results of Gok (2014). However, it is inconsistent with the results of a survey conducted by Reinholz et al. (2022) on implementing inquiry teaching in 20 universities. The traditional view is that active learning is beneficial to all students. However, Reinholz et al. (2022) found gender differences in the performance of women and men in inquiry classes that did not exist in non-inquiry comparison samples.

The main results of this research have largely been validated by previous researchers, who have shown that exposure to active learning has improved the self-confidence, communication ability, and problem-solving ability of college students majoring in physical education. The interaction between teachers and students has also increased (Arslan, 2010). In addition to proving the benefits of the curriculum itself, a line was drawn in this study between

teacher-centred and student-centred teaching, which demonstrated the necessity of combining both methods to ensure the effectiveness of the curriculum (Nuñez Enriquez & Oliver, 2021). According to the experimental research results, the problem-solving ability of the students majoring in physical education at a university had improved after 32 hours of active learning intervention. It can be proved that the active learning teaching method is more effective than the traditional teaching approach (Rönnlund et al., 2021).

6. Conclusion

The purpose of this study was to improve the problem-solving ability of college students majoring in physical education based on the use of an active learning physical education curriculum. This was a quasi-experimental research design, and the study sample consisted of 60 college students majoring in physical education in China. The 30 students in the EC were taught with active learning methods, whereas the 30 students in the CC received no intervention. The PSI for physical education majors was used to evaluate the influence on the students before and after the experiment.

It was evident from the experiment results that the students' problem-solving ability in both the EC and CC had improved after 8 weeks (32 class hours) of teaching. However, the improvement of those in the experimental group was more remarkable. Therefore, the students in the EC had made remarkable progress in terms of their problem-solving ability than those in the CC. This study has shown that college students can improve their problem-solving abilities by using active learning methods rather than traditional teaching (Görücü, 2016).

In summary, an active learning physical education curriculum can improve the problem-solving ability of physical education majors. Hence, PE majors in colleges and universities in China whose problem-solving ability is weak can greatly improve based on active learning teaching methods.

References

Åkerlind, G. S. (2004). A new dimension to understanding university teaching. *Teaching in Higher Education, 9*(3), 363-375. https://doi.org/10.1080/1356251042000216679

Allen, J. T., Drane, D. D., Byon, K. K., & Mohn, R. S. (2010). Sport as a vehicle for socialization and maintenance of cultural identity: International students attending American universities. *Sport Management Review, 13*(4), 421-434. https://doi.org/10.1016/j.smr.2010.01.004

Anderson, J. R., Greeno, J. G., Reder, L. M., & Simon, H. A. (2000). Perspectives on learning, thinking, and activity. *Educational Researcher, 29*(4), 11–13. https://doi.org/10.3102/0013189X029004011

Arslan, E. (2010). Analysis of communication skill and interpersonal problem solving in preschool trainees. *Social Behavior and Personality: An International Journal, 38*(4), 523-530. https://doi.org/10.2224/sbp.2010.38.4.523

Bellet, B. S., & Kozlowski, S. (2008). Active learning: Effects of core training design elements on self-regulatory processes, learning, and adaptability. *Journal of Applied Psychology, 93*(2), 296-316. https://doi.org/10.1037/0021-9010.93.2.296

Benlahcene, A., Lashari, S. A., Lashari, T. A., Shehzad, Muhammad, W. S., & Deli, W. (2020). Exploring the perception of students using student-centered learning approach in a Malaysian Public University. *International Journal of Higher Education, 9*(1), 204–217. https://doi.org/10.5430/ijhe.v9n1p204

Catalano, G. D., & Catalano, K. (1999). Transformation: From teacher-centered to student-centered engineering education. *Journal of Engineering Education, 88*(1), 59-64. https://doi.org/10.1002/j.2168-9830.1999.tb00412.x

Charles, K. (2014). Do you want your students to be job-ready with 21st century skills? Change pedagogies: A pedagogical paradigm shift from Vygotskyian social constructivism to critical thinking, problem solving and siemens' digital connectivism. *Journal of Higher Education, 3*(3), 81-91. https://doi.org/10.5430/ijhe.v3n3p81

Chen, C., Yang, S., & Cui, M.J. (2010). Reliability and validity of the Chinese version of the Problem Solving Questionnaire (PSI) among college students. *Chinese Journal of Clinical Psychology, 18*(1), 26-27. https://doi.org/10.16128/j.cnki.1005-3611.2010.01.032

Chen, P., Tolmie, A., & Wang, H. (2017). Growing the critical thinking of schoolchildren in Taiwan using the Analects of Confucius. *International Journal of Educational Research, 84*, 43-54. https://doi.org/10.1016/j.ijer.2017.02.002

Cheng, S. C., Hwang, G. J., & Chen, C. H. (2019). From reflective observation to active learning: A mobile experiential learning approach for environmental science education. *British Journal of Educational Technology, 50*(5), 2251-2270. https://doi.org/10.1111/bjet.12845

Chitpin, S., & Evers, C. W. (2005). Teacher professional development as knowledge building: A Popperian analysis. *Teachers and Teaching, 11*(4), 419-433. https://doi.org/10.1080/13450600500137208

Chiu, P. H. P., & Cheng, S. H. (2017). Effects of active learning classrooms on student learning: A two-year empirical investigation on student perceptions and academic performance. *Higher Education Research & Development, 36*(2), 269-279. https://doi.org/10.1080/07294360.2016.1196475

Coalter, F. (2010). The politics of sport-for-development: Limited focus programmes and broad gauge problems? *International Review for the Sociology of Sport, 45*(3), 295-314. https://doi.org/10.1177/1012690210366791

Cooper, K. M., Downing, V. R., & Brownell, S. E. (2018). The influence of active learning practices on student anxiety in large-enrollment college science classrooms. *International Journal of STEM Education, 5*(1), 1-18. https://doi.org/10.1186/s40594-018-0123-6

Deslauriers, L., McCarty, L. S., Miller, K., Callaghan, K., & Kestin, G. (2019). Measuring actual learning versus feeling of learning in response to being actively engaged in the classroom. *Proceedings of the National Academy of Sciences, 116*(39), 19251-19257. https://doi.org/10.1073/pnas.1821936116

Earley, M. A. (2007). Developing a syllabus for a mixed-methods research course. *International Journal of Social Research Methodology, 10*(2), 145-162. https://doi.org/10.1080/13645570701334118

El-Zein, A. H., & Hedemann, C. (2016). Beyond problem solving: Engineering and the public good in the 21st century. *Journal of Cleaner Production, 137*, 692-700. https://doi.org/10.1016/j.jclepro.2016.07.129

Erlingsson, C, & Brysiewicz, P. (2013). Orientation among multiple truths: An introduction to qualitative research. *African Journal of Emergency Medicine, 3*(2), 92–99. https://doi.org/10.1016/j.afjem.2012.04.005

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences of the United States of America, 111*(23), 8410-8415. https://doi.org/10.1073/pnas.1319030111

Gok, T. (2014). Peer instruction in the physics classroom: Effects on gender difference performance, conceptual learning, and problem solving. *Journal of Baltic Science Education, 13*(6), 776-788. https://doi.org/10.33225/jbse/14.13.776

Gorucu, A. (2016). The investigation of the effects of physical education lessons planned in accordance with cooperative learning approach on secondary school students' problem solving skills. *Educational Research and Reviews, 11*(10), 998-1007. https://doi.org/10.5897/ERR2016.2756

Görücü, A., & Cantav, E. (2017). A comparison of students in physical education and sports college and the students in other departments in terms of problem solving skills. *Journal of Education and Training Studies, 5*(5), 36-45. https://doi.org/10.11114/jets.v5i5.2310

Häkkinen, P., Järvelä, S., Mäkitalo-Siegl, K., Ahonen, A., Näykki, P., & Valtonen, T. (2017). Preparing teacher-students for twenty-first-century learning practices (PREP 21): A framework for enhancing collaborative problem-solving and strategic learning skills. *Teachers and Teaching, 23*(1), 25-41. https://doi.org/10.1080/13540602.2016.1203772

Hang, Y., Chen, P., & Yu, T. (2019). Reading and Writing Learning Strategies for Low English Proficiency Students at a Private University in China. *International Journal of Higher Education, 8*(3), 214-225. https://doi.org/10.5430/ijhe.v8n3p214

Heppner, P. P., & Baker, C. E. (1997). Applications of the problem solving inventory. *Measurement and Evaluation in Counseling and Development, 29*(4), 229-241. https://doi.org/10.1080/07481756.1997.12068907

Heppner, P. P., Witty, T. E., & Dixon, W. A. (2004). Problem-solving appraisal and human adjustment: A review of 20 years of research using the problem solving inventory. *Counseling Psychologist, 32*(3), 344-428. https://doi.org/10.1177/0011000003262793

Heppner, P. P., & Petersen, C. H. (1982). The development and implications of a personal problem-solving inventory. *Journal of Counseling Psychology, 29*(1), 66-75. https://doi.org/10.1037/0022-0167.29.1.66

Huang, S. Y., Kuo, Y. H., & Chen, H. C. (2020). Applying digital escape rooms infused with science teaching in elementary school: Learning performance, learning motivation, and problem-solving ability. *Thinking Skills and Creativity, 37*, 1-48. https://doi.org/10.1016/j.tsc.2020.100681

Jesionkowska, J., Wild, F., & Deval, Y. (2020). Active learning augmented reality for STEAM education-A case study. *Education Sciences, 10*(8), 198-213. https://doi.org/10.3390/educsci10080198

Jin, A. (2013). Physical education curriculum reform in China: A perspective from physical education teachers. *Physical Education and Sport Pedagogy, 18*(1), 15-27. https://doi.org/10.1080/17408989.2011.623231

Katić, E. K. (2008). Preservice teachers' conceptions about computers: An ongoing search for transformative appropriations of modern technologies. *Teachers and Teaching: Theory and Practice, 14*(2), 157-179. https://doi.org/10.1080/13540600801983344

Kourmousi, N., Xythali, V., Theologitou, M., & Koutras, V. (2016). Validity and reliability of the problem solving inventory (PSI) in a nationwide sample of Greek educators. *Social Sciences, 5*(2), 1-11. https://doi.org/10.3390/socsci5020025

Kroll, L. R. (2004). Constructing constructivism: How student-teachers construct ideas of development, knowledge, learning, and teaching. *Teachers and Teaching, 10*(2), 199-221. https://doi.org/10.1080/1354060042000188035

Lee, E., & Hannafin, M. J. (2016). A design framework for enhancing engagement in student-centered learning: Own it, learn it, and share it. *Educational Technology Research and Development, 64*(4), 707-734. https://doi.org/10.1007/s11423-015-9422-5

Lleixa, T., Gonzalez-Arevalo, C., & Braz-Vieira, M. (2016). Integrating key competences in school physical education programmes. *European Physical Education Review, 22*(4), 506-525. https://doi.org/10.1177/1356336X15621497

Maksymchuk, I., Sitovskyi, A., Savchuk, I., Maksymchuk, B., Frytsiuk, V., Matviichuk, T., ... Bilan, V. (2018). Developing pedagogical mastery of future physical education teachers in higher education institutions. *Journal of Physical Education and Sport, 18*(2), 810-815. https://doi.org/10.7752/jpes.2018.02119

Mitchell, M. F., Lawson, H. A., van der Mars, H., & Ward, P. (2021). Pathways toward desirable futures. *Journal of Teaching in Physical Education, 40*(3), 423-430. https://doi.org/10.1123/jtpe.2020-0247

Nopembri, S., Sugiyama, Y., Saryono, & Rithaudin, A. (2019). Improving stress coping and problem-solving skills of children in disaster-prone area through cooperative physical education and sports lesson. *Journal of Human Sport and Exercise, 14*(1), 185-194. https://doi.org/10.14198/jhse.2019.141.15

Nuñez Enriquez, O., & Oliver, K. L. (2021). 'The collision of two worlds': When a teacher-centered facilitator meets a student-centered pedagogy. *Sport, Education and Society, 26*(5), 459-470. https://doi.org/10.1080/13573322.2020.1738374

Paul, B., & Lord, R. N. (2021). The impact of physically active learning during the school day on children's physical activity levels, time on task and learning behaviors and academic outcomes. *Health Education Research, 36*(3), 362-373. https://doi.org/10.1093/her/cyab020

Penney, D., & Jess, M. (2004). Physical education and physically active lives: A lifelong approach to curriculum development. *Sport, Education and Society, 9*(2), 269-287. https://doi.org/10.1080/1357332042000233985

Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education, 93*(3), 223-231. https://doi.org/10.1002/j.2168-9830.2004.tb00809.x

Rahman, M. M. (2019). 21st century skill "problem solving": Defining the concept. *Asian Journal of Interdisciplinary Research, 2*(1), 64-74. https://doi.org/10.34256/ajir1917

Reinholz, D., Johnson, E., Andrews-Larson, C., Stone-Johnstone, A., Smith, J., Mullins, B., ... Shah, N. (2022). When active learning is inequitable: Women's participation predicts gender inequities in mathematical performance. *Journal for Research in Mathematics Education, 5*3(3), 204-226. https://doi.org/10.5951/jresematheduc-2020-0143

Rönnlund, M., Bergström, P., & Tieva, Å. (2021). Teaching in a non-traditional classroom: Experiences from a teacher-initiated design project. *Teachers and Teaching, 27*(7), 587-601. https://doi.org/10.1080/13540602.2021.1977274

Smither, K., & Zhu, X. (2011). High school students' experiences in a Sport Education unit: The importance of team autonomy and problem-solving opportunities. *European Physical Education Review, 17*(2), 203-217. https://doi.org/10.1177/1356336X11413185

Steiner, G., & Posch, A. (2006). Higher education for sustainability by means of transdisciplinary case studies: An innovative approach for solving complex, real-world problems. *Journal of Cleaner Production, 14*(9-11), 877-890. https://doi.org/10.1016/j.jclepro.2005.11.054

Tsangaridou, N., & O'Sullivan, M. (2003). Physical education teachers' theories of action and theories-in-use. *Journal of Teaching in Physical Education, 22*(2), 132-152. https://doi.org/10.1123/jtpe.22.2.132

Umbach, P. D., & Wawrzynski, M. R. (2005). Faculty do matter: The role of college faculty in student learning and engagement. *Research in Higher Education, 46*(2), 153–184. https://doi.org/10.1007/s11162-004-1598-1

Varea, V., & González-Calvo, G. (2021). Touchless classes and absent bodies: Teaching physical education in times of Covid-19. *Sport, Education and Society, 26*(8), 831-845. https://doi.org/10.1080/13573322.2020.1791814

Vekkaila, J., & Pyhältö, K. (2016). Doctoral student learning patterns: Learning about active knowledge creation or passive production. *International Journal of Higher Education, 5*(2), 222-235. https://doi.org/10.5430/ijhe.v5n2p222

Vidal, R. V. V. (2009). Creativity for problem solvers. *AI & Society, 23*(3), 409–432. https://doi.org/10.1007/s00146-007-0118-1

Wahlström, N. (2022). Curriculum policy, teaching, and knowledge orientations. *Teachers and Teaching*, 1-17. https://doi.org/10.1080/13540602.2022.2159364

Younis, A. A., Sunderraman, R., Metzler, M., & Bourgeois, A. G. (2021). Developing parallel programming and soft skills: A project based learning approach. *Journal of Parallel and Distributed Computing, 158*, 151-163. https://doi.org/10.1016/j.jpdc.2021.07.015