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Designing Smart Classroom Teaching Model in Basketball Courses for Student Teachers in Higher Education Institutes

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Abstract

Background and Aim: At present, college basketball teachers adopt traditional teaching methods in the process of teaching. Most basketball teachers ignore students' feelings when teaching the theory class, and the lack of interest in the class leads to a lack of initiative in the learning process of basketball class, and students to achieve the expected results. This research aimed to design a smart classroom teaching model in basketball for student teachers' higher education institutes and to confirm the smart classroom designed model on satisfaction, appropriateness, and practicality among the stakeholders.

Materials and Methods: The population in surveying was 97 persons in higher education institutes in Guangzhou consisting of administrators, basketball teachers, audiovisual staff, computer staff, 11 experts in in-depth interviews, 21 experts in consensus by Delphi, and 11 stakeholders to confirm the designed smart classroom teaching model. The research instrument was a questionnaire for surveying which the IOC was .95 (.66-1.00), questionnaire for consensus by Delphi which the IOC was .98 (.66-1.00). The data was analyzed with descriptive statistics on mean, standard deviation, percentage, median, and interquartile range.

Results: The results found that the designed smart classroom teaching model in basketball for student teachers in higher education institutes consists of 1) Facility, rooms, and adjacent basketball court. 2) Equipment and devices 3) Computer networks and communication networks 4) Digital Software 5) Support staff 6) Teachers' Preparations 7) Students' Preparation 8) Webpage.

Conclusion: The study concluded that a successful smart classroom teaching model for basketball in higher education necessitates a comprehensive setup that includes physical facilities, technology infrastructure, digital tools, and well-prepared teachers and students, all supported by dedicated staff. This comprehensive approach creates an ideal learning environment for student teachers.

Keywords: Smart classroom; Basketball course; Student teachers; Higher education institutes

Introduction

In 2016, China's Ministry of Education issued a notice on the "13th Five-Year Plan" of Education Informatization, emphasizing the all-around development of young people, the promotion of new teaching modes, and the establishment of a modern education system (Hua, 2016). Since the 18th National Congress of the Communist Party of China, education informatization has been developing rapidly development, and the 19th National Congress proposed the implementation of an education informatization 2.0 action plan to promote the development of education informatization (Yu, 2023). Among them, intelligent education, smart classrooms, visual reality, audio reality, biomechanics analysis, clips, online lessons, and social communications were interrogated in the field of education. Has become an important content of education informatization. The smart classroom was one of the teaching models that was more effective than the traditional classroom because it could mix various devices, teaching methods, and applications to motivate the students to participate in the teaching and learning process.

At present, college basketball teachers adopt traditional teaching methods in the process of teaching. Most basketball teachers ignore students' feelings when teaching the theory class, and the lack of interest in the class leads to a lack of initiative in the learning process of basketball class, and students to achieve the expected results.

Cai (2018) believed that the smart classroom teaching mode is that in the intelligent classroom environment, teachers create a learning environment and learning space, and deeply integrate and innovate the application of teaching resources and teaching technology. Reconstruction classroom teaching organization and scene, provide accurate guidance solutions and processes for students to carry out experiential learning, mixed

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learning, and personalized learning, to construct and interpret the new intelligent teaching mode of personalized teaching, situational teaching, and mixed teaching. Li Yang and others think the wisdom classroom teaching mode is improved based on the original teaching mode, the development of wisdom classroom teaching mode in this drive under the background of the development of education, the main body is mainly teachers and students, all around the principle of "student" teaching, wisdom classroom teaching mode is to promote the development of students' wisdom and innovation mode of (Li, 2018).

The application of intelligent classroom teaching into the smart classroom model in the basketball courses of student teachers in sports and physical education colleges and universities was a response to the improvement of teaching and learning in sports and physical education and drive to a reform and breakthrough of the compulsory courses of basketball in sports colleges and universities.

The research problem centers on the need to modernize and enhance the teaching of basketball in sports and physical education colleges and universities. Despite significant advancements in education informatization in China, traditional teaching methods still dominate basketball courses, leading to a lack of student engagement and interest. The introduction of smart classroom technology, which integrates various devices, teaching methods, and applications, presents an opportunity to revitalize basketball instruction. This study explores how applying intelligent classroom teaching within the smart classroom model can improve the effectiveness of basketball courses, driving a necessary reform in sports education.

Objectives

The purpose of this research is to find out as follows:

1. To design a smart classroom teaching model in basketball for student teachers in higher education.
2. To study a problem about teaching and learning management of basketball.
3. To collect a factor to support the teaching and learning management of basketball through a smart classroom model.
4. To gather the smart classroom, designate opinions by discussing with experts.
5. To confirm the smart classroom design model on satisfaction, appropriateness, and practicality among the stakeholders.

Literature review

Smart Classroom

Smart Classroom refers to a classroom or learning environment specially designed, distinct from regular classrooms, generally intended to enhance and develop the teaching and learning experience, training, as well as skills and knowledge in various areas that learners can apply in the future. It emphasizes interactive learning, along with a diverse range of media technologies in various formats that contribute to the overall learning and teaching experience, both within the classroom and outside. Effective distance learning is also a focus, guided by the smart classroom's visionary framework, as follows:

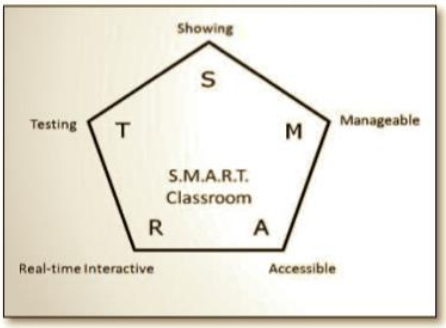

Figure 1 Concept map of the smart classroom (Huang et al, 2012)

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1. S: Showing and demonstrating the ability to present information and instructional content through instructional technology.

2. M: Manageable Possessing the ability to manage the organization of teaching systems, media, equipment, resources, and the environment in a smart classroom.

3. A: Accessible Demonstrating the capability to access learning information through the use of media, tools, and equipment in a smart classroom.

4. R: Real-time Interactive Exhibiting the ability to interact in real-time while creating interactive learning experiences, including learning through media, tools, and responsive technology in a smart classroom.

5. T: Testing Demonstrating proficiency in testing or quality assurance for teaching and learning activities, as well as assessing learning behavior through the use of a smart classroom.

The concept of innovation and educational technology with smart classrooms

Smart classrooms are considered an innovation that corresponds to the educational technology perspective for managing one form of distance education. The primary aim is to empower learners to enhance their efficiency and effectiveness in learning. This is achieved by enabling learners to independently manage their learning through various technologies and internet systems (Ken, 2013). This amalgamation of innovation and educational technology in smart classrooms is a cohesive and well-integrated concept.

In summary, the ideas of innovation and educational technology in the context of smart classrooms, as discussed underscore the seamless integration of these concepts in enhancing the learning and teaching experience."

1. Individual Differences Concept in Smart Classroom Management:

In managing smart classrooms where learners are encouraged to engage in self-directed learning, a key concept revolves around recognizing the individual differences among learners. This approach fosters the exchange of information, knowledge, and learning experiences among individual learners through various channels. Each learner has the opportunity to acquire knowledge from diverse sources, and subsequently, they contribute by exchanging, analyzing, synthesizing, and processing this knowledge. The goal is to generate new knowledge and apply the acquired insights to various subjects or daily life situations.

2. Readiness Concept in Smart Classroom Course Design:

The readiness concept in designing courses for smart classroom instruction can be aligned with the principles of learning psychology, emphasizing the individual's readiness for learning as something that can be self-generated. Effective management of smart classrooms involves tailoring courses to suit the individual learner's level of readiness. In doing so, smart classroom instruction becomes diverse and tailored to the unique readiness of each learner. This approach ensures that the content is both varied and suitable for the individual readiness levels of the learners.

3. Learner-Centered Concept:

The learner-centered concept places significant emphasis on the role of the learner in exploration, critical thinking, and synthesizing information to construct knowledge independently. Learners play a crucial role, and educators must plan educational strategies, formats, teaching methods, and assessments that align with each learner's abilities. Ultimately, the entire educational process revolves around making the learner central to the experience.

4. Cooperative Learning Concept:

The cooperative learning concept fosters a social learning community, encouraging learners to confidently question, exchange knowledge, and create an atmosphere that reduces anxiety in the teaching and learning process. This is achieved by integrating educational technology into the design, creating channels for information exchange, facilitating communication among learners, between learners and educators, and involving various media. Utilizing the internet system provides diverse pathways for cooperative learning, enhancing the overall learning experience.

5. inequality Reduction in Education Concept:

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Due to the rapid dissemination of knowledge through technology and internet systems, the current educational landscape faces challenges of unequal access. The traditional approach of instructors being the sole transmitters of knowledge may not keep pace, and new information constantly emerges. To address this, the most effective method for instructors to impart knowledge is by providing tools for learners to access information independently. In this scenario, instructors take on the role of guides, offering advice and managing the learning process, ensuring equitable access to knowledge.

The concept of innovation and educational technology in smart classrooms aligns to enhance learners' efficiency and effectiveness in learning. This is achieved by facilitating self-directed learning through various technologies and internet systems. The integration of technology in education has led to the emergence of diverse strategies for achieving sustainable internationalization, as seen in the experiences and perspectives of teachers in China (Qian & Azzeddine, 2023). In the digital era, technology has become an essential tool for teachers in implementing learning models and creating creative and innovative learning spaces (Autthawuttikul et al, 2022) The implementation of digital school management through the Smart Classroom program has been shown to make learning more effective, innovative, and comprehensive (Sizka & Zainal, 2023). Educational technology courses play a crucial role in equipping education majors with the necessary skills to incorporate technology into their lesson plans and classroom activities (Luo, 2023). However, the successful implementation of technology in education requires a paradigm shift for teachers and the development of a system-wide educational technology plan (Holden, 2013).

Theories related to learning design and smart classroom teaching

Theories Related to the Design of Teaching and Learning in Smart Classrooms are classrooms that integrate technology into teaching and learning to make learning more efficient and engaging. The design of teaching and learning in smart classrooms should therefore take into account different learning theories to ensure that teaching and learning are appropriate and achieve their goals.

1. Constructivism emphasizes that learners are the constructors of their knowledge, using their own experiences and thinking processes. The design of teaching and learning in smart classrooms should therefore be designed to allow learners to participate in learning in a variety of ways, such as group activities and project work. This will allow learners to develop analytical, synthetic, and problem-solving skills on their own.

2. Cooperative learning emphasizes that learners work together in groups, exchanging and helping each other learn. The design of teaching and learning in smart classrooms should be designed to promote cooperative learning, such as group discussion activities and group project activities. This will allow learners to develop teamwork skills and analytical thinking skills.

3. Self-directed learning emphasizes that learners are responsible for their learning by setting goals, planning their learning, and evaluating their learning outcomes. The design of teaching and learning in smart classrooms should be designed to promote self-directed learning, such as giving learners tasks or problems to go and find answers to. This will allow learners to develop self-learning skills and analytical thinking skills.

The design of teaching and learning in smart classrooms should take into account different learning theories to ensure that teaching and learning are appropriate and achieve their goals. The learning theories that are often applied in smart classrooms are constructivism, cooperative learning, and self-directed learning.

Steps in Designing and Developing Teaching and Learning in Smart Classrooms

The steps in designing and developing teaching and learning that are suitable for smart classrooms should focus on a process that reflects the view of the learning process that creates knowledge or skills in critical thinking, synthesis, processing, creative thinking, and problem-solving on their own. It is also important to have interaction in exchanging and sharing knowledge. The following steps are recommended (Jiransuwan, 2013):

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1. Define learning objectives to understand the goals of the teaching and learning that you want students to learn or develop skills from learning with smart classrooms. The objectives of learning that the learner determines will be specific goals that the learner sets for themselves from that learning session.

2. Analysis includes:

2.1 Analyze the learning context by analyzing the real environment to see what knowledge, skills, and complexity of the problem are. Analysis will help in preparing a variety of information resources and other resources for students to use in analysis, synthesis, processing, problem-solving, or creating a summary that is related to the learning objectives that have been set.

2.2 Analyze the learner by analyzing the perspectives or foundations of individual learners that exist before participating in learning to be aware of the individual differences of learners towards their knowledge and abilities in the process of creating knowledge.

3. Selecting teaching methods is a method for transmitting content to learners in a variety of communication methods that are appropriate for the content and learning objectives. It is considered an opportunity for learners to respond to individual differences in the use of media in smart classrooms. It is also considered to be creating meaningful learning and promoting the creation of knowledge that is awake for learners.

4. Preparing additional teaching support sources so that learners can access information related to teaching and increase their skills in critical thinking, synthesis, and problem-solving on their own.

5. Assessment of smart classroom learning needs to be comprehensive in a 360-degree manner, including the teaching and learning process, learning progress, learning outcomes, and feedback from learning. To check if learners have developed all the skills from learning through media in smart classrooms on their own.

These steps can help to ensure that teaching and learning in smart classrooms is effective and meets the needs of learners.

Technology Trends Supporting Smart Classroom Teaching for Basketball Instruction in Sports Universities

The following are the technology trends that support smart classroom teaching for basketball instruction in sports universities: (Bui & Lee, 2023; Krieger et al (2021).

Virtual reality (VR) can be used to simulate basketball-playing situations in a virtual environment, allowing players to practice various skills more safely and efficiently. For example, players can practice dribbling, shooting, moving in confined spaces, and playing in various situations. The use of virtual reality (VR) in basketball training offers several advantages over traditional training methods:

1. Increased Safety: VR eliminates the risk of physical injuries associated with practicing certain skills in a real-world environment. For instance, players can safely practice dunking or shooting over defenders without the risk of falling or colliding with others.

2. Enhanced Efficiency: VR allows for targeted and repetitive practice of specific skills, enabling players to focus on particular aspects of their game without the distractions of a crowded gym or court. This focused practice can lead to faster skill development.

3. Personalized Training: VR can create personalized training experiences tailored to the individual needs of each player. By analyzing player performance data, VR systems can identify strengths and weaknesses and provide customized drills and scenarios to address those areas.

4. Immersive Learning: VR creates an immersive environment that mimics real-game situations, allowing players to develop game awareness, decision-making skills, and the ability to react under pressure.

5. Varied Practice Scenarios: VR provides access to a wide range of practice scenarios, from one-on-one drills to full-court games, allowing players to experience different game situations and develop adaptability.

6. Immediate Feedback: VR systems can provide real-time feedback on player performance, allowing for immediate correction and improvement of technique.

Examples of VR Applications in Basketball Training:

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1. Dribble Training: Players can practice dribbling through virtual cones or defenders, focusing on ball control, footwork, and speed.

2. Shooting Training: Players can practice shooting from various distances and angles, receiving real-time feedback on shot trajectory and release mechanics.

3. Footwork Training: Players can practice footwork drills and agility exercises in a virtual environment, improving balance, coordination, and quickness.

4. Game Simulation: Players can participate in simulated game scenarios against virtual opponents, developing game awareness, decision-making, and situational awareness.

The use of VR in basketball training is still in its early stages, but it has the potential to revolutionize the way players learn and develop their skills. As VR technology continues to advance, we can expect to see even more innovative and effective applications in the field of basketball training.

Augmented reality (AR) can be used to add information or instructions to players during practice. For example, players can see the positions of their teammates or opponents on the court, or they can immediately see instructions on how to dribble or shoot. Augmented reality (AR) offers several advantages for basketball training:

1. Enhanced Visual Cues: AR overlays digital information onto the real-world environment, providing players with real-time visual cues that can improve their understanding and execution of plays. For instance, AR can highlight passing lanes, indicate defensive positioning, and demonstrate proper shooting mechanics.

2. Improved Decision-Making: AR can provide players with real-time tactical information, such as opponent positioning, teammate movements, and game clock status. This information can help players make more informed decisions on the court, leading to better plays and improved game performance.

3. Personalized Feedback: AR can provide players with personalized feedback on their technique and performance. For example, AR can track player movements and compare them to ideal technique, providing real-time feedback on dribbling, shooting, and footwork.

4. Enhanced Engagement: AR can make training sessions more engaging and interactive by incorporating gamification elements, such as virtual challenges, rewards, and leaderboards. This increased engagement can motivate players and promote more effective learning.

5. Increased Accessibility: AR can make training more accessible to players of all skill levels. By providing clear visual cues and instructions, AR can help beginners grasp essential concepts and techniques, while also providing advanced players with the opportunity to refine their skills.

Examples of AR Applications in Basketball Training:

1. Visualization of Plays: AR can overlay virtual diagrams or animations onto the court, allowing players to visualize and practice complex plays without the need for physical setup.

2. Real-Time Tactical Information: AR can display real-time game data, such as shot percentages, player statistics, and opponent tendencies, helping players make informed decisions based on current game conditions.

3. Personalized Shooting Feedback: AR can track a player's shooting mechanics, providing real-time feedback on shot trajectory, release point, and hand positioning.

4. Virtual Opponents and Dribbling Drills: AR can create virtual opponents, allowing players to practice ball handling, dribbling drills, and footwork against simulated defenders.

5. Interactive Basketball Court: AR can transform a regular basketball court into an interactive training environment, providing players with a variety of drills, challenges, and games.

AR technology is still evolving, but its potential in basketball training is significant. As AR systems become more sophisticated and accessible, we can expect to see even more innovative and effective applications that enhance player development and game performance.

Artificial intelligence (AI) can be used to analyze player performance data to identify the strengths and weaknesses of each player. This information can be used to develop personalized training programs for players more effectively. For example, AI can analyze player performance data to identify which skills a

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player can develop more than other skills, or which situations a player is likely to make mistakes. Artificial intelligence (AI) has the potential to revolutionize basketball training by providing personalized and data-driven insights that can help players improve their skills and performance. Here are some of the key benefits of using AI in basketball training:

1. Personalized Training Programs: AI can analyze player performance data to identify individual strengths, weaknesses, and areas for improvement. This information can then be used to develop personalized training programs tailored to each player's specific needs.

2. Real-Time Feedback and Analysis: AI can provide real-time feedback on player performance, allowing coaches to make adjustments to drills and strategies on the fly. This real-time analysis can help players identify and correct mistakes immediately, leading to faster skill development.

3. Predictive Analytics: AI can analyze historical data and current trends to predict player tendencies and potential mistakes. These predictive analytics can help coaches anticipate player behavior and develop strategies to counter opponents' moves.

4. Injury Prevention: AI can analyze player movements and biomechanics to identify potential risks for injury. This information can help coaches develop training programs that focus on injury prevention and strengthening exercises.

5. Talent Identification and Development: AI can analyze performance data to identify promising young players and provide them with early intervention and support. This can help accelerate the development of future basketball stars.

Here are some examples of how AI is being used in basketball training today:

1. Player Tracking Systems: AI-powered tracking systems can monitor player movements, speed, and shot accuracy, providing coaches with detailed insights into individual performance.

2. Shot Analysis Software: AI software can analyze shot trajectories, release points, and ball spin to help players improve their shooting mechanics.

3. Opponent Scouting Tools: AI can analyze opponent game films to identify tendencies, weaknesses, and strengths, allowing coaches to develop game plans accordingly.

4. Performance Prediction Models: AI can predict player performance based on historical data, allowing coaches to make informed decisions about lineups and substitutions.

As AI technology continues to advance, we can expect to see even more innovative and effective applications in basketball training. AI has the potential to transform the way players are trained, developed, and evaluated, leading to a new era of athletic excellence in the world of basketball.

In addition to these technologies, other technologies can be used to support basketball instruction in sports universities, such as motion tracking technology, image analysis technology, and machine learning technology.

Human pose estimation (HPE) is a computer vision technique that identifies and tracks the positions of human body parts in an image or video. This technology has the potential to revolutionize the way we provide real-time feedback and analysis in sports training, particularly for shooting performance. Here are some specific ways in which human pose applications can be used to improve shooting performance:

1. Real-time feedback on shooting mechanics: HPE can be used to track the positions of key body parts involved in shooting, such as the shoulders, elbows, wrists, and hands. This information can be used to provide real-time feedback on shooting mechanics, such as posture, alignment, and trigger pull.

2. Identification and correction of technical flaws: HPE can be used to identify and correct technical flaws in shooting techniques. For example, HPE can be used to detect excessive movement of the body, improper grip, or premature trigger pull.

3. Personalized training drills: HPE data can be used to develop personalized training drills that address specific weaknesses in an athlete's shooting mechanics.

4. Analysis of game footage: HPE can be used to analyze game footage and identify patterns in an athlete's shooting performance. This information can then be used to develop more effective game strategies and prepare for upcoming opponents.

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The smart classroom focuses on enhancing teachers' instructional outcomes and the intelligent generation of students' learning results. In a smart classroom, teachers need to possess data literacy to design strategic teaching activities effectively. Throughout the teaching process, intelligent teaching by teachers, intelligent learning by students, and continuous evaluation and reflection of these methods create a complete intelligent cycle. This approach encourages deep student engagement in the entire learning process, fosters the development of students' wisdom, and guides them in achieving intelligent learning outcomes.

Conceptual Framework

The conceptual frameworks in smart classroom model in basketball for students. Teachers in higher education institutes present graphic figures from input process output. Input means the independent variables; the process means the activated operation of independent variables to get the results and the output is the results after activating the process. In this research, the inputs were components in the smart classroom, readiness to establish a smart classroom in basketball, computer technology distributions and Learning management, teaching and learning theory, and effectiveness of the smart classroom teaching model. The processes were the surveying of problems, readiness, and suggestions on the smart classroom, expert interviews then running the content analysis to form the conceptual framework and design smart classroom concept, consensus on the opinions from experts, and then drafting the smart classroom model in basketball and confirm by connoisseurship with stakeholders, The output was a design of smart classroom model in basketball for student teachers in higher education which effectiveness and was accepted by stakeholders.

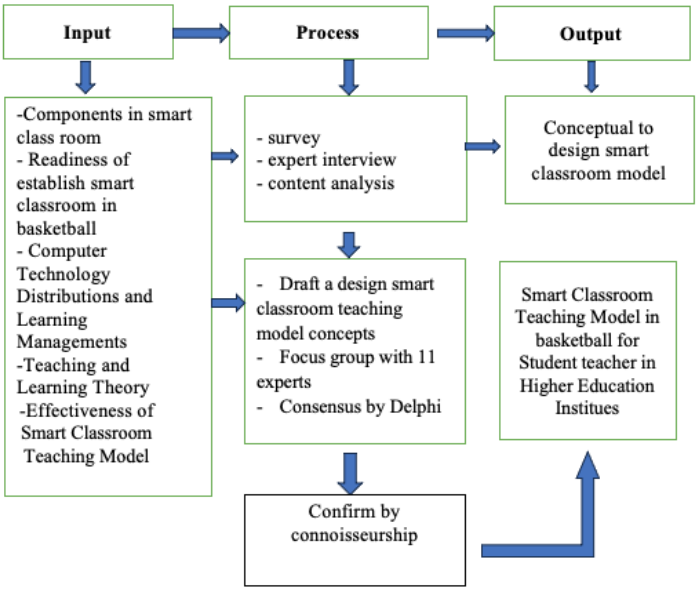

Figure 2 Conceptual Framework

Methodology

Research Tools

In this research, the research tools are as follows: (1) Semi-Structure Interviewing form; (2) Questionnaires to collect problems basketball teaching and learning in the smart classroom; (3) Questionnaires for Delphi; (4) Recording form to collect data by connoisseurship of stakeholders.

Population and Sample

The population was administrators, teachers, and audiovisual aids support staff concerned with the management, teaching, and learning in basketball from 7 universities, with a total of 97 persons. 11 exerts which consisted of academic scholars in basketball teaching and learning, specialists in audiovisual aids, a

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specialist in computers, a specialist in teaching methodology were invited to conduct an expert interview. 21 experts which consisted of 7 university basketball teachers, the head of audiovisual aids of 7 universities, 4 university administrators, and 3 experts on computers, were invited to conduct consensus by Delphi. 11 experts consisted of university 2 administrators, 2 audiovisual staff, 3 basketball teachers, 2 computers, 2 students teachers mature in basketball, were invited to conduct connoisseurship to confirm the model.

Data Collection

11 experts were interviewed to collect information from the researchers via videocall during 15-20 August 2023, a researcher called to invite them to be experts in this research, explained the research project, and made an appointment to videocall an interview.

A questionnaire was distributed to 97 persons to gather problems, readiness to establish smart classrooms in basketball, and suggestions on smart classrooms and returned with completed data 91 cases.

Consensus 21 experts by Delphi technique, the Liker's scale questionnaire was distributed to experts for 2 rounds to collect the decision on smart classroom contents devices and methods and used as a teaching and learning to enhance the outcome learning of the student's teacher in basketball.

Drafting a Smart Classroom Teaching Model

Connoisseurship with 11 stakeholders to confirm the designed smart classroom teaching model.

Data Analysis

The data from experts interviewing was analyzed by content analysis. The data from questionnaire surveying was analyzed by descriptive statistics on frequencies, percentages, mean, and standard deviation. Data from consensus by the Delphi technique was analyzed by the median and interquartile range (IQR). The data from connoisseurship was analyzed by content analysis.

Results

Part I. To survey problems, readiness, and suggestions concerned with smart classrooms of the personnel concerned with the establishment of smart classrooms in basketball for student teacher university.

The researcher developed a questionnaire to survey the need assessment concerned problems, current observations, and expected needs for smart classrooms for basketball in student-teacher universities. The questionnaire was distributed to 97 teachers in 7 universities and returned 91 cases. The data is in Table 1.

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Table 1 The mean and standard of the samples' opinions on the survey of smart classrooms for basketball.

No	ISSUES	$\bar{x}$	SD	Levels
A.	Ability of staff in smart classroom devices			
1	Knowledges and practice on the use of camera, projectors, speakers	3.86	0.68	high
2	Knowledge and practices on smartphone in exercise and sports	3.60	.77	high
3	Knowledge and practices on VR (Visual Reality)	2.77	.94	moderate
4	Knowledge and practices on AR (Augmented Reality)	3.02	.83	moderate
5	Knowledge and practices on smartphone in exercise and sports	3.70	.64	high
6	Knowledge and practices on smartwatches	3.34	.76	high
7	Knowledge and practices on biomechanics program in sport analysis such as Dartfish, Human Pose Estimation, and etc.	1.82	.61	low
8	Staffs and teachers could use the sport analysis program.	1.82	.56	low
B	Knowledge and practice of supported teaching techniques			
9	Knowledges and practice on "The Flipped Classroom Techniques",	2.02	.68	low
10	Knowledges and practice on "The Peered Assist Techniques"	3.01	.41	moderate
11	Knowledges and practice on "The Buddy Drill Techniques"	4.52	.64	very high
12	Knowledges and practice on "The Self Studying Techniques"	3.54	.86	high
13	Knowledges and practice on "The Student-Centered Techniques"	4.69	.46	very high
14	Knowledge and practice on "The Sport teaching and coaching Techniques"	3.34	1.03	moderate
C	Ability in basketball teachers with technology			
15	Software /application for smart classroom in basketball	3.14	.83	moderate
16	Human Pose Estimation or Dartfish	2.01	.64	low
17	Application in Physical fitness Test	2.98	.48	moderate
18	Production of clip and video on basketball teaching and training	2.61	.78	moderate
19	Texts concerned basketball, physical training, basketball training and competition	4.68	.47	very high
20	Production of lessons for self-learning in basketball	3.27	.80	moderate
21	Production of poster	3.71	.63	high
22	Production of Test, measurement, and evaluation in basketball	4.69	.46	very high
23	Prefer to spend time to response question and answer with students	4.02	.74	high
24	We Chat, online meeting	3.80	.60	high
D	The students' abilities			
25	Students had good skills in basketball	4.27	.59	very high

Table 1 (cont)The mean and standard of the samples' opinions on the survey of smart classroom for basketball.

No	ISSUES	$\bar{x}$	SD	Levels
26	Students interested in basketballs	5.00	.00	very high
27	Students like to study by himself	3.70	.60	high
28	Students had experiences in teaching and leaning on flipped classroom.	2.35	.70	moderate
29	Students had experiences in collaborative working and learning	2.64	.72	moderate
31	Students had enough knowledge and practice to use the smartphone	5.00	.00	very high
32	Students had enough knowledge and practice to use the smartwatch	3.96	.60	high
33	Students had enough knowledge and practice to use the computers	4.97	.14	very high
34	Students had time to study by himself out of class time.	4.07	.61	
E	The students' self-support			
35	Students could possess a smart watch	3.85	.62	high
36	Students could possess a smartphone	4.93	.24	very high
37	Students could possess a computer	3.86	.60	high
38	Students accepted WeChat group and the others group communication	4.91	.28	very high
F	The university preference in supporting of facility and equipment by university			
39	Room to establish smart classroom in basketball	4.69	.55	very high
40	Five sets of computers.	4.83	.37	very high
41	Projector in classroom	4.78	.41	very high
42	Projectors in basketball court	3.79	.64	high
43	CCTV Cameras	3.51	.76	high
44	One set of speakers with wireless microphone	4.95	.20	very high
45	Digital whiteboard	3.05	.54	moderate
46	Smartwatches or Polar devices	2.94	.43	moderate
47	Stop watch	4.65	.61	very high
G	The University's preference in supporting of software and applications			
48	Human Pose Estimation or Dartfish	2.62	.76	moderate
48	Human Pose Estimation or Dartfish	2.62	.76	moderate
49	Application in Health such as BMI,	4.92	.26	very high
50	Application in Physical fitness Test	4.86	.34	very high
No	ISSUES	M	SD	Levels
51	Clip and video on basketball teaching and training	4.69	.46	very high
52	Contents on basketball	4.75	.43	very high
53	Posters on basketball	4.61	.48	very high
54	Texts concerned basketball, physical training, basketball training and competition	4.74	.43	very high
55	Test, measurement, and evaluation in basketball	4.75	.43	very high
56	Attendance record systems	4.73	.44	very high
57	Computer network, WIFI, Online conference, online classroom	4.65	.47	very high

The questionnaire results showed that the university must be concerned about the ability of staff on smart classroom devices, and teaching methods to support the use of them in class.

Part II: To form a concept of a smart classroom in basketball

The researcher took the data from surveying on problems and readiness to establish smart classrooms in higher education institutes, reviewed literature, and expert interviews to form a concept, and components of smart classrooms, and developed a Likert-type questionnaire to gather a consensus from 21 experts by the Delphi technique. The results of the consensus by Delphi are found in Table 2.

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Table 2 The Data of Delphi Collecting

Items	Variables	Mdn	IQR	Decision*
A. Contents for smart classroom				
1	Attendance: Biological screen to enter, Time of staying in page	4.00	1.00	keep
2	Contents on basketball: history, game plays, regulation and rules	5.00	0.00	keep
3	Contents in Physical fitness: Knowledge and practice	5.00	0.00	keep
4	Practice: basketball skills, practice and criteria	5.00	0.00	keep
5	Practice: Physical fitness, practice and criteria	5.00	0.00	keep
6	Assignment / Tests and evaluation	5.00	0.00	keep
7	Information/Note / Question and answer	5.00	0.00	keep
8	Communication, WeChat, Zoom	5.00	0.00	keep
B Facility and Equipment				
1	Room to establish smart classroom control	5.00	0.00	keep
2	Sets of computers.	5.00	0.00	keep
3	Projector in room	5.00	0.00	keep
4	Projectors in basketball court	5.00	0.00	keep
5	TV monitors	4.00	1.00	keep
6	CCTV Cameras	5.00	0.00	keep
7	Set of amplifier, speakers, and wireless microphone	5.00	0.00	keep
8	Digital whiteboard	5.00	0.00	keep
9	Smartwatches or Polar devices	5.00	0.50	keep
10	Linkage to library, fitness center or room, Internet network	5.00	0.00	keep
C. Software Program				
1	Physical fitness test	5.00	0.00	keep
2	Sport Biomechanics software (Human Pose analysis or Dartfish)	5.00	0.00	keep
3	Basketball Video Analysis Software	4.00	1.00	keep
4	Application to connect with smartphone	5.00	0.00	keep
5	Communication application: WeChat,	5.00	0.00	keep
6	Online teaching application: Zoom, Google meet etc.	5.00	1.00	keep
7	WIFI camera application	5.00	1.00	keep
D. Teachers Development on smart class room device				
1	Knowledges and practice on the use of camera, projectors, speakers	5.00	0.00	keep
2	Knowledge and practices on smartphone in exercise and sports	5.00	0.00	keep
3	Knowledge and practices on VR (Visual Reality)	5.00	1.00	keep
4	Knowledge and practices on AR (Augmented Reality)	5.00	1.00	keep
5	Knowledge and practices on smartwatches	5.00	0.00	keep
6	Knowledge and practices on biomechanics program in sport analysis such as Dartfish, Human Pose Estimation, and etc.	5.00	0.50	keep
E. Teachers development on teaching methods				
1	Knowledges and practice on "The Flipped Classroom Techniques"	5.00	0.50	keep
2	Knowledges and practice on "The Peered Assist Techniques"	5.00	0.00	keep
3	Knowledges and practice on "The Buddy Drill Techniques"	5.00	0.00	keep
4	Knowledges and practice on "The Self Studying Techniques"	5.00	0.00	keep
5	Knowledges and practice on "The Student-Centered Techniques"	5.00	0.00	keep
6	Knowledge and practice on "The Sport teaching and coaching Techniques"	5.00	0.00	keep
7	Knowledge and practice on "Basketball teaching and learning"	5.00	0.00	keep
F. Students preparation				
1	The content and practice on smart class room teaching and learning (benefit, objective, process, role of students and teachers etc.)	5.00	0.00	keep
2	The use and maintenance of smart classroom devices	5.00	0.00	keep
3	The regulation of smart classroom learning (attendance, practice, assignments, and evaluation)	5.00	0.00	keep
4	The knowledge and practice on modern teaching techniques	5.00	0.00	keep
5	The knowledge and practice on application to connect with smart class room program	5.00	0.00	keep
6	The devices requirement (smartwatch, smartphone, computer)	5.00	0.50	keep
G	University supports			
1	Provide rooms, facilities and equipment to establish smart classroom for basketball.	5.00	0.00	keep
2	Support staff to manage and service on the smart classroom	5.00	0.00	keep
3	Staffs' development to operate and service the smart class room device, support the teaching and learning,	5.00	0.00	keep
4	Teachers' development on knowledge and practice on smart class room teaching and learning	5.00	0.00	keep
5	Support the teachers to produce the contents, video clip, for teaching and learning	5.00	0.00	keep

*The Items were accepted by the Criteria of Mdn. > 3.50 or IQR. < 1.50

Table 2 shows that the designed smart classroom model was accepted by the 21 experts at a very high agree on 47 items, there were just only 3 items which were accepted at a high agree on "Attendance: Biological screen to enter, Time of staying in the page", "TV monitors" and "Basketball Video Analysis Software"

Part III: To Confirm the readiness of the institutes to establish a smart classroom

The conclusion interviewed data from the 9 key persons at Guangzhou Sport University (GSU) were the basketball teachers, administrator, audio-visual staff, and computer staff to confirm the readiness of establishment of a smart classroom in basketball university, it could be concluded as in table 3.

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Table 3 The conclusion of the in-depth interview from key person opinions of GSU staff

No.	Items	decisions		Level perceptions
1	The room to set the smart classroom close to the basketball	yes		moderate
2	The facility and equipment as audiovisual aids, computers, projectors and speakers	yes		very high
3	The CCTV connection from basketball court to smart class room	yes		moderate
4	The fitness center and linkage network to smart class room	yes		very high
5	Intranet, internet in university which could connect to, library, www	yes		very high
6	Support the software on biomechanics analysis as Dartfish, Human Pose Estimation	yes		very high
7	Support online teaching and learning	yes		very high
8	Support the system for teaching and learning though smart technology such as login, assignment, test and evaluation	yes		moderate
9	Support smart device to monitor the biofeedback as Polar, smartwatches, and application	yes		very high
10	GSU could provide a webpage to run smart classroom	yes		high
11	GSU support the inquiry martials to support smart classroom teaching and learning as texts, video, clips, applications	yes		very high
12	GSU support personnel to run the smart class room	yes		moderate
13	GSU support the training for teachers and staff to understand and practice of smart class room	yes		high
14	GSU support the training of smart classroom teaching and learning to students	yes		moderate
15	The establishment of smart class room to be a pilot project of university which could expand to the Guangzhou Training Center	yes		high

Table 3 teachers in universities at moderate through very high levels. The key persons viewed that the GSU could support the items on facility, and equipment, which concerned teaching and learning such as audiovisual aids, communication networks, and the connection of smart classroom and university networks. The uncertainty items were the room for the smart classroom station, personnel to run the smart classroom, the CCTV in the basketball court, and the training for students to use the smart classroom. These should be considered of faculty to aware and must solve the problems.

Part IV: to design a smart classroom model and confirm the appropriateness and practicality of the model

Researchers summarized the data from reviewed literature, experts interviewed, consensus data from Delphi, and interviews on readiness to establish smart classrooms to draft the design of smart classrooms in basketball for student teachers institutes as follows.

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Table 4 The components in designed smart classroom in basketball in student teachers' institutes

No.	Groups and details	Functions	Equipment and software
1	Facility, and rooms.		
	1. Control room	Operating and monitor all events in smart classroom activity, teachers monitoring and teaching	2 Set of computers for controller and teacher
	2. Classrooms	Lectures and meeting	1 set of computers 1 projector 1 set of audio media 1 digital whiteboard
	3. Small section rooms	Section for small classroom teaching and practice	Each room should have: 1 set of computers 1 TV monitor
	4 Self- study room	Room with tables, computers for students to use	Table and electrical outlet
	5 Basketball court and goals	Teaching and practice, it should have more goals for small group practices and individual practice	Wireless CCTV camera, 1 cover the court and 2 for each goal
2	Computer networks	To connect with library and worldwide communication networks	WIFI, Modem, Applications
3	Software	to connect with worldwide connection, and utilize in teaching learning, practicing, analyzing and research	Dartfish, Human Pose Movement Analysis, Fitness tests and evaluation program. Health monitor application,
4	Webpage	Provide the communication to the clients	Outline of Webpage: -Log in, -Smart class room page logo -Contents in basketball -Contents in Fitness -Clip on basketball teaching and practice - Information/Note/ and Communication (WeChat) - Assignments and results
5	Teachers' preparation		
		- Knowledge and practice in devices	-Training in AV equipment -Training in software and application -Smartwatch and smartphone for teaching and learning -Contents and AV Aids Productions
		Teaching and learning methods	Methods of teaching - Flipped classroom - Peered assist - Buddy drills - Group discussion - Self-studying - Basketball teaching and coaching technique -Collaborative learning techniques - Micro teaching methods - Fitness testing and evaluation -Basketball skill testing and evaluation -Online teaching and learning -Online testing and evaluation
		Teaching and learning methods	Methods of teaching - Flipped classroom - Peered assist - Buddy drills - Group discussion - Self-studying - Basketball teaching and coaching technique -Collaborative learning techniques - Micro teaching methods - Fitness testing and evaluation -Basketball skill testing and evaluation -Online teaching and learning -Online testing and evaluation
6	Students' preparation		
		Knowledge and practice of smart class room	- Smart classroom concepts - Knowledge and practice of devices -Smart class room regulation -Teaching and learning through smart class room model
		Necessary device possession for students to support a smart classroom learning	Computer Smart phone Smart watch
7.	Support Staff and Student volunteers	Support teachers and students to operate the smart classroom To service	Audiovisual officers Computer officers Student volunteers

The Confirmation of the Designed Smart Classroom

11 stakeholders which consisted of academic administrators, the chairman of faculty, the head of the facility office, audiovisual staff, computer staff, senior basketball teachers, and senior students conducted connoisseurship to confirm the possibility, appropriateness, and practicality of the designed smart classroom model.

They accepted the ideas and components of the designed smart classroom in basketball and have some opinion to operate the smart classroom model.

1. At the first stage, the faculty should prepare a proposal to the university.

2. Set the committee to work on a smart classroom project.

3. At originated stage, the smart classroom should prepare for the minimum scale and gradually add more in the future.

4. The staff to handle the smart classroom service, the faculty may train some of the faculty staff to respond to it and train students to be volunteers to support this job. Also, trained student volunteers to help the staff.

5. The expansion to the center of Guangzhou was a good idea and could find some support from governments.

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6. It could be concluded that the stakeholders accepted the smart classroom in basketball for student teachers as useful, appropriate, and practical to establish in a student-teacher university.

Designed Smart Classroom in Basketball Model for Student Teachers in Higher Institutes

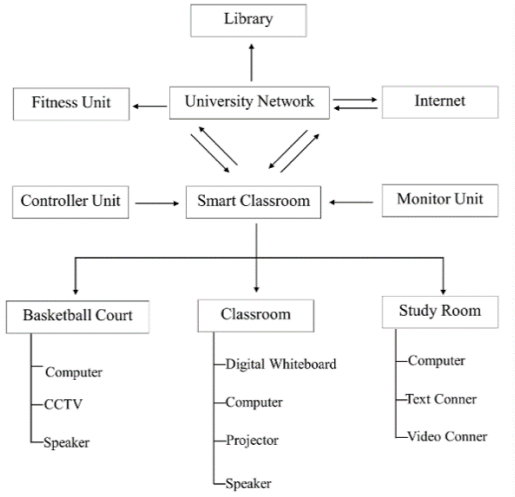

Figure 2 The diagram of the Designed Smart Classroom in Basketball Model

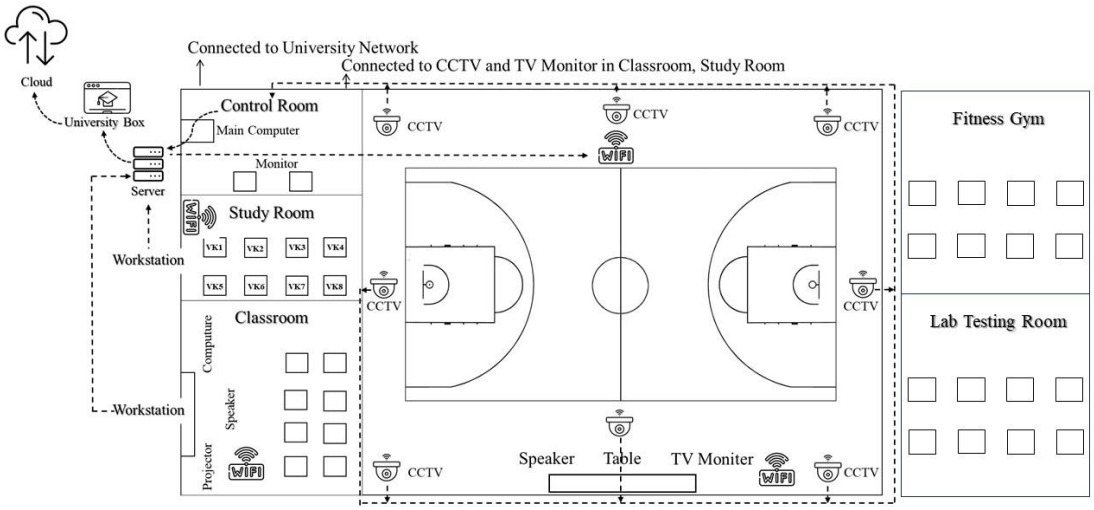

Figure 3 The diagram of facility and equipment in the basketball court for the designed smart classroom teaching model in basketball for student teachers in higher education institutes

The research results found that the designed smart classroom teaching model in basketball for student teachers in higher education institutes comprised of 1) Facility, rooms, and adjacent basketball court. 2) Equipment and devices 3) Computer networks and communication networks 4) Digital Software 5) Support staff 6) Teachers' Preparations 7) Students' Preparation 8) Webpage. The component's details are as follows:

1. Facility: The smart classroom in basketball is composed of a control room, a study room classroom

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with equipment, a fitness room, and a basketball court.

2. Equipment and devices: computers, projectors, audiovisual aids, CCTV, TV monitors.

3. Networks: 1) The computer networks connected to the university communication network and subsections in the smart classroom, library, fitness test unit, and WIFI, 2) communication network supports among teachers and students in the smart classroom.

4. Software: Dartfish, Human Pro Estimation, Online meeting, smartphone connection, smartwatch connection.

5. Support staff: 1) The maintenance of the smart classroom 2) The webpage administration, smart classroom service to support teachers and students.

6. Teachers' preparations: 1) Training on modern teaching and learning techniques through smart classroom and Internet technology 2) Training on the knowledge and practice of smart classroom devices, biomechanical analysis 3) Production of texts, video clips, and documents to support the e-learning.

7. Student preparations: 1) Training on modern teaching and learning and 2) Training on the knowledge and practice of smart classroom devices, regulation, and service. 3) The devices support smart classroom teaching and learning, self-studying which students must possess.

8. Webpage: 1) Attendance: Biological screen to enter, Time of staying in page 2) Contents on basketball: history, game plays, regulation and rules, Contents in Physical fitness: Knowledge and practice 3) Practice: basketball skills, practice and criteria of test, Practice: Physical fitness, practice and criteria of tests 4) Assignment / Tests and evaluation Information/Note 5) Question and answer 6) Communication channels, WeChat, Zoom.

Discussion

Smart classrooms are environments that incorporate technology into teaching and learning to enhance efficiency and engagement. Therefore, the design of teaching and learning in these classrooms should consider various learning theories to ensure that instruction is appropriate and effective in achieving educational goals. The research results revealed that the smart classroom teaching model in basketball for student teachers in higher education institutes consists of the following components: 1) Facilities, including rooms and adjacent basketball courts, 2) Equipment and devices, 3) Computer and communication networks, 4) Digital software, 5) Support staff, 6) Teacher preparation, 7) Student preparation, and 8) webpage. This is consistent with the research result of Qian & Azzeddine (2023) which indicated that the concept of innovation and educational technology in smart classrooms aligns to improve learners' efficiency and effectiveness. This is accomplished by enabling self-directed learning through the use of various technologies and internet systems. The integration of technology in education has given rise to diverse strategies for achieving sustainable internationalization, as reflected in the experiences and perspectives of teachers in China.

From the stakeholder's interview results, they suggested that the university could provide support for facilities and equipment related to teaching and learning, including audiovisual aids, communication networks, and the integration of smart classrooms with university networks. However, there are uncertainties regarding the availability of a dedicated room for the smart classroom station, personnel to manage the smart classroom, CCTV in the basketball court, and training for students on using the smart classroom. These issues should be addressed by the faculty to ensure awareness and problem-solving. This is consistent with the research result of Ken (2013) which suggested that smart classrooms are regarded as an innovative approach that aligns with the educational technology perspective for managing a form of distance education. The primary goal is to empower learners to increase their efficiency and effectiveness in learning. This is accomplished by enabling learners to independently manage their education through various technologies and internet systems. The integration of innovation and educational technology in smart classrooms forms a cohesive and well-integrated concept. Including, Autthawuttikul. et al (2022) indicated that in the digital era, technology has become a crucial tool for teachers to implement learning models and create creative, innovative learning environments. The use of digital school management

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through the smart Classroom program has proven to make learning more effective, innovative, and comprehensive.

Recommendation

Recommendation for this research

The smart classroom as this research was a combination type of a traditional classroom and an IT (Information Technology) classroom by adding internet things to gain more advantages in teaching and learning which can use both on-site and online teaching and learning so the university must support software, hardware to operate a smart classroom.

The university should provide training courses for teachers and students on knowledge and practice of smart classroom devices and, modern teaching methods.

The smart classroom must pay a high number of budgets to establish and operate, so it should be shared the service to the other institutes and basketball teams.

Recommendation for further research

Study the expansion of the smart classroom by adding the contents and practice of the other sports courses to cover various sports teaching and training in the university.

Research on the feasibility of servicing this smart classroom for the other institutes.

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