



Needs analysis for the visual auditory kinesthetic (VAK) model using smart floor in physical education, sports, and health learning in elementary schools

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Article info	Abstract
Keywords: Auditory, kinesthetic, needs analysis, sport, visual	This study presents the needs of the VAK game model using Smart Floors in Physical Education, Sports, and Health learning for elementary school students. Using Smart Floors (a technology-based interactive surface) as part of technological advancements provides sports facilities that can enhance exercise, prevent injuries, and create a more engaging sports experience for elementary school students. A descriptive exploratory design with a mixed-method approach was used as the research method. The study was conducted at five elementary schools in Palembang. Participants involved as informants were 200 fourth and fifth-grade elementary students and five sports teachers. Data collection techniques were observation (direct surveys to schools), interviews, questionnaires, and documents. Data analysis techniques were carried out quantitatively and qualitatively. The results of the needs analysis concluded that teachers and students gave a positive response to the need for a Physical Education, Sports, and Health learning model, and with the percentage of 'agree' and 'strongly agree' responses from students reaching >70% for the audio and visual content aspects, strengthening the findings of this needs analysis. The most desired game model was based on traditional games, supported by technology. The VAK game model using Smart Floor was created to contain 1) content aspects (audio, visual, and kinesthetic), 2) process aspects (exploration, elaboration, and confirmation), and 3) impact aspects. Based on the findings of this needs analysis, the design of the VAK game model should be implemented using various traditional games. The research implications indicate that the findings provide a concrete basis for the design and development phase of the VAK game model, which is based on Smart Floors and traditional games.

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1. Introduction

Physical education, sports, and health for elementary school students in grades 4 and 5 cover various physical activities, such as large and small ball games, athletics, gymnastics, rhythmic movements, and physical fitness development. The material taught is quite diverse and requires attention from sports teachers, given the characteristics of elementary school students who still have the nature of children and prefer play activities. Physical education is one phase of the overall education program that contributes mainly through movement experiences, growth, and overall development for every elementary school student (Harold W. Kohl et al., 2013b). All forms of physical activity or daily human movement activities always require physical support and physical fitness (Ma et al., 2023; Marković et al., 2023; Neil-Sztramko et al., 2021).

Physical education, sports, and health learning for elementary school students is not an easy activity that directs students to understand the theory or practice of sports. Moreover, each elementary school in various regions of Indonesia is different, as research has previously found many problems related to sports learning (Riadi & Satria, 2023). Elementary schools in Palembang also have various issues that are always different. The analysis results of teaching and learning report documents from five sports teachers from five schools in the 2023-2024 academic year found several findings of problems related to Physical Education, Sports and Health learning activities, including 1) from the student aspect, the focus is on the character of elementary school students who prefer playing activities so that learning time is wasted by directing students' attention when practicing sports, 2) sports facilities that are still conventional and limited. This means the school has not provided digital technology learning media facilities. One of the technological facilities is a bright floor which can give elementary school students a fun, interactive and dynamic sports activity experience. A colourful floor is equipped with advanced technology and can be considered a flexible type of sports field (Cocconcelli et al., 2023; Heller et al., 2014). Smart floors are an interactive learning medium that can integrate visual (light, display), auditory (sound, music), and kinesthetic (physical movement) elements simultaneously. 3) Based on the teacher's aspect, it was found that in teaching competence and several things related to teaching, teachers only explain the theory and ask students to practice.

Derived from the findings of these problems, it can be concluded that there is a mismatch between children's learning styles (playing, moving) and passive and less varied teaching methods. Teachers lack innovation in learning models related to student personality, student needs, developments in science, and technology in implementing education. The learning model should be a priority concern for teachers before teaching (Harold W. Kohl et al., 2013a). Hence, the problem of the success of sports learning is influenced by factors of school management, teachers, students, and learning facilities (Mashud, 2020).

The results of observations and group discussions with sports teachers at public elementary schools in Palembang concluded that teachers have not been able to create a learning model designed according to students' perspectives. They make learning only according to their perspectives. Therefore, from the findings of the problem, the study focused on analysing the needs for the design of the VAK game model. However, researchers also tried to use Smart Floors as sports practice mats for several sports that use mats. Games are the choice in this study, considering the character of elementary students who still like to play and do a lot of movement or jokes when sports learning activities occur. Games develop students' thinking patterns more critically and increase competitiveness and strategic abilities in competing. Thus, games are not only oriented to being entertaining games, but also a medium to improve critical and creative thinking patterns (Febrilyani, 2019; Freitas & Liarokapis, 2011; Koivisto & Hamari, 2019; Ružic & Dumancic, 2015; Walz & Deterding, 2015).

Numerous previous studies have shown the effectiveness of games in learning Physical Education, Sports and Health. Even visual, auditory and kinesthetic learning models have a positive impact on student achievement and also on problem-solving skills (Nurhamza et al., 2019; Pramasiha et al., 2023; Rahmawati et al., 2017; Ramadian et al., 2020; Risnawati et al., 2018). The development of a traditional game-based athletic learning model for grade IV Elementary students has good quality as a learning resource (Susanto et al., 2022). Learning using the VAK concept with various media assistance provides quite significant effectiveness (Santhi et al., 2020). Therefore, games equipped with both conventional and digital technology media provide more enjoyable sports learning, students are more motivated, effective and improve academic achievement (Asshagab et al., 2020; Dahliana et al., 2023; Liu et al., 2021; Megawati et al., 2023; Mustahibah et al., 2024; Novita et al., 2019; Yoda et al., 2022a, 2022b).

Stemming from the findings of the problem and previous research studies, it can be understood that elementary students have unique characteristics seen from their age development. Games are the right choice to accommodate this need. However, this study presents a different research procedure from the previous one, namely, in the VAK game using Smart Floors for grades 4 and 5. While research on the VAK model and game-based learning is abundant, research specifically analysing the need to synergise VAK pedagogy, interactive technology (bright flooring), and local wisdom content (traditional games) in the context of elementary school physical education is still minimal. This concept creates a gap that differentiates the research conducted so that it can contribute to the development of sports science, technology, and local wisdom values as a means of shaping student character. This research not only analyses the needs of the VAK model but also integrates it with "Smart Floor" technology and the local wisdom of traditional games within a holistic framework. The novelty presented is different from previous studies related to the concept of the VAK game, in that it is in accordance with students' perceptions and refers to students' daily lives. Thus, the VAK game used can also teach character values.

Accordingly, this study aims to obtain the needs of the VAK game model using Smart Floors in Physical Education, Sports and Health learning for elementary students. The research results are expected to provide benefits in developing knowledge on exploring the needs of developing learning models, such as using games for sports learning for elementary school students. In addition, it can be used as input to improve the professionalism of sports teachers who are relevant to the development of sports teaching science and technology.

2. Method

A descriptive exploratory design with a mixed methods approach was used as the research method. Mixed methods research is a research approach that combines the collection and analysis of quantitative and qualitative data in one study. This approach allows researchers to gain a more comprehensive understanding of a research problem by utilising the strengths of both methods (Creswell, 2012; Creswell & Creswell, 2018; Creswell, J.W., Clark, 2017). Hence, this study combines quantitative survey data with qualitative interviews. In addition, this research design is based on the understanding that the needs analysis for developing the VAK game model using Smart Floor in Physical Education, Sports, and Health learning in Elementary Schools in Palembang can be carried out comprehensively and according to students' target needs.

This research was conducted in five elementary schools in Palembang to explore the needs analysis data collected from January to May 2025. The participants involved as informants were 200 fourth—and fifth-grade Elementary School students and five sports teachers. The selection of fourth—and fifth-grade students is considered an informant who already understands the

learning context and provides reliable information regarding students' understanding of the game models needed in Physical Education, Sports, and Health learning.

Data collection techniques include observation (direct surveys of schools), interviews, questionnaires, and documents.

2.1 Documents are taken from reports of teaching and learning activities carried out by sports teachers in the 2023-2024 academic year

2.2 Observations are used to explore problems in preliminary research

2.3 Interviews (open-ended interviews) were conducted with sports teachers related to the teaching and learning of physical education, sports and health that have been carried out so far. the following are interview questions addressed to sports teachers;

2.3.1 Does the learning of physical education, sports and health that has been carried out so far have objectives in line with current scientific and technological developments?

2.3.2 Does the learning of physical education, sports and health that has been carried out so far use games that are suitable for the characteristics of elementary school students?

2.3.3 Is the physical education, sports, and health learning carried out so far equipped with technological learning media such as smart floor?

2.3.4 Does the learning of physical education, sports and health that has been carried out so far have a learning strategy that directs students to practice?

2.3.5 Is the learning of physical education, sports and health carried out so far under the needs and backgrounds of students?

2.4 The questionnaire was used to determine students' perspectives on the needs of the VAK game model using Smart Floor. The questionnaire items for students used a Likert scale with five answer points, namely 1) Strongly Agree (SA = 5), 2) Agree (A = 4), 3) Neutral (N = 3), 4) Disagree (D = 2), and 5) Strongly Disagree (SD = 1).

The following is the instrument for the needs analysis questionnaire for the VAK game model using a bright floor (Priansa, 2017).

Table 1. Instrument for needs analysis in developing vak game models using smart floors

No	Components	Questions	SA	A	N	D	SD
1	Content: Type of VAK Game required	Q1. The type of VAK game model I need for Physical Education, Sports, and Health learning is clear and sound.					
		Q2. The type of VAK game model I need in Physical Education, Sports, and Health learning has example material using digital technology media					
		Q3. The type of VAK game model I need in Physical Education, Sports, and Health learning can be practised using Smart Floor.					
		Q4. The type of VAK game model I need in Physical Education, Sports, and Health learning is per the learning objectives in the syllabus.					
		Q5. The type of VAK game model I need in Physical Education, Sports, and Health learning					

No	Components	Questions	SA	A	N	D	SD
		has the relevant content of the material that students must master					
2	Process: Stages of implementing the VAK game	Q6. The type of VAK game model I need in Physical Education, Sports, and Health learning focuses on students' understanding of the material independently and enjoyably. Q7. The type of VAK game model I need in Physical Education, Sports, and Health learning can help students integrate and absorb new knowledge and skills that suit my learning styles. Q8. The type of VAK game model I need in Physical Education, Sports, and Health learning can help students apply and expand their sports knowledge. Q9. The type of VAK game model I need in Physical Education, Sports, and Health learning is implemented with Smart Floor media that students like. Q10. The type of VAK game model I need in Physical Education, Sports, and Health learning is taught systematically.					
3	Results: Impact of VAK gaming	Q11. The type of VAK game model I need in Physical Education, Sports, and Health learning can help students practice sports easily. Q12. The type of VAK game model I need in Physical Education, Sports, and Health learning can improve students' academic achievement. Q13. The type of VAK game model I need in Physical Education, Sports, and Health learning can help students understand sports material comprehensively. Q14. The type of VAK game model I need in Physical Education, Sports, and Health learning can be easily used using Smart Floor. Q15. The type of VAK game model I need in Physical Education, Sports, and Health learning can provide learning interest.					

This closed questionnaire focuses on the design of needs related to the basic concept of the VAK game. However, the researcher also prepared open-ended questionnaire questions, namely;

- a. Should VAK games for sports learning refer to traditional games?
- b. Should VAK games for sports learning refer to modern games?

- c. Should VAK games for sports learning refer to games accessed via smartphones?
- d. Are VAK games for sports learning used in various ways according to the student's learning style map?

The questionnaire instrument was tested for content validity by experts and for reliability using Cronbach's Alpha. Data analysis techniques were carried out quantitatively and qualitatively. Student questionnaires were analysed using descriptive statistics. Meanwhile, interview results were analysed using thematic content analysis (Braun et al., 2021). The thematic analysis process, in stages, included interview transcription, code generation (coding), grouping codes into categories, and formulating main themes. Two independent reviewers coded the data to identify themes and ensure reliability through cross-validation. Triangulation was also used to increase the credibility of the findings by cross-verifying data from various sources and methods (Carter et al., 2014; Miles et al., 2014; Patton, 2015). Combining quantitative (questionnaire) and qualitative (interview) data provides a comprehensive understanding of this study's needs.

3. Results

The analysis of interview data with five teachers concluded that the learning activities of Physical Education, Sports, and Health, which so far consist of two parts, namely 1) the teacher explains the material and continues with practical activities, and 2) the teacher makes an assessment. Hence, the learning activities seem dull. The results of direct observations in the field for three months in January-March 2025 also showed that students played more and were not focused. The results of the interview data analysis are summarised into essential points, as follows.

Table 2. Findings of teachers' answers for analysis of needs for developing VAK game models using smart floors

No	Questions	Summary of Teacher's Interview Answer
1	Do Physical Education, Sports, and Health learning that has been carried out so far have objectives based on current scientific and technological developments?	a. Learning objectives have been designed according to the content of the material that must be taught in grades four and five. b. Learning objectives have been designed according to the applicable curriculum and follow government policies. c. Teachers also formulate learning objectives according to the character map and the needs of students in grades four and five.
2	Does the Physical Education, Sports, and Health learning that has been carried out so far use games appropriate to the characteristics of elementary students?	a. Sports learning activities are not taught with games and only focus on students practising according to the teacher's example. b. Learning activities take place on understanding theoretical and practical concepts only, and there is no variation in learning strategies, let alone combined with games suitable for children.
3	Is the Physical Education, Sports, and Health learning carried out so far equipped with technological learning media, such as a bright floor?	a. Sports facilities do not have innovative mats or digital technology tools. b. Schools only provide sports equipment or tools such as balls, regular mats, etc.

No	Questions	Summary of Teacher's Interview Answer
4	Does the Physical Education, Sports, and Health learning carried out so far have a learning strategy that directs students towards practice?	Sports learning activities are more directed towards practice than studying theory in class, so that students do more activities outside the classroom or on the field.
5	Is the Physical Education, Sports, and Health learning that has been carried out so far based on students' needs and backgrounds?	Physical education, sports, and health learning activities are carried out per the syllabus in the school's implemented curriculum.

The results of teacher interviews indicate that physical education, sports and health learning activities in five elementary schools in Palembang, in Table 1, do not use games or variations in learning models. Teachers only teach activities that tend to be conventional or teacher-centred. Every lesson, the teacher explains the practised physical activities and continues with the students doing physical activities according to the teacher's example.

Meanwhile, the results of the needs analysis for the development of the VAK game model using Smart Floors in Physical Education, Sports, and Health learning in Elementary Schools concluded that students respond positively to the use of the VAK game model for these purposes because they think they can do it while playing. The results of the needs analysis are presented in Table 3.

Table 3. Percentage of needs analysis result in developing vak game models using smart floors

Components	Questions	Answer Points (%)				
		SA	A	N	D	SD
Content: Type of VAK Game required	Q1	72.5	20	5	2.5	0
	Q2	55	35	7.5	2.5	0
	Q3	35	60	5	0	0
	Q4	55	45	0	0	0
	Q5	50	43	7	0	0
Process: Stages of implementing the VAK game	Q6	67.5	20	10	2.5	0
	Q7	75	25	0	0	0
	Q8	60	32.5	5	2.5	0
	Q9	81.5	18.5	0	0	0
	Q10	85.5	6	8.5	0	0
Results: Impact of VAK gaming	Q11	91	9	0	0	0
	Q12	44	39	11	0	0
	Q13	49	43.5	7.5	0	0
	Q14	70.5	27	2.5	0	0
	Q15	82.5	17.5	0	0	0

The percentage data in Table 3 is also displayed using a graphic to clarify the table. The graphic is divided into three graphs to describe the needs analysis: Figure 1 (content aspect), Figure 2 (process learning), and Figure 3 (result: impact). Each statement in the needs analysis includes five answer choices that present percentages. The following is the percentage of the

distribution of the needs analysis questionnaires that have been analysed, as displayed in Figure 1, Figure 2, and Figure 3.

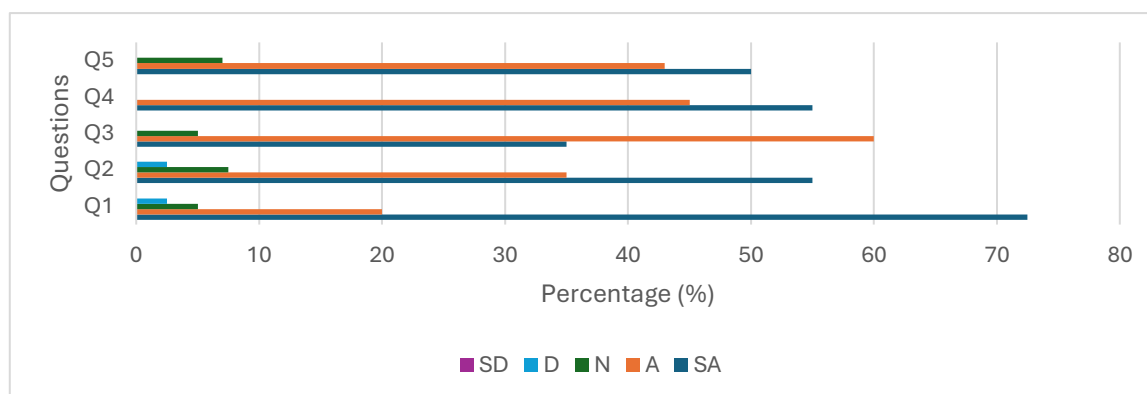


Figure 1. Content of the VAK game model using smart floors in physical education, sports, and health learning

Figure 1 is the percentage of the desired content aspects for the VAK game model using Smart Floors in Physical Education, Sports and Health learning according to the students' perspective. In terms of content, the VAK game model using smart floors has sound (72.5% / strongly agree), can be seen (55%), and is easy to practice (60% / agree). Derived from the students' perspective, it also concluded that the VAK game model must be relevant to the learning objectives to be achieved from this subject (55% / strongly agree) and the VAK game content must be in accordance with the needs of the sports material taught for grades 4 and 5 (50% / strongly agree).

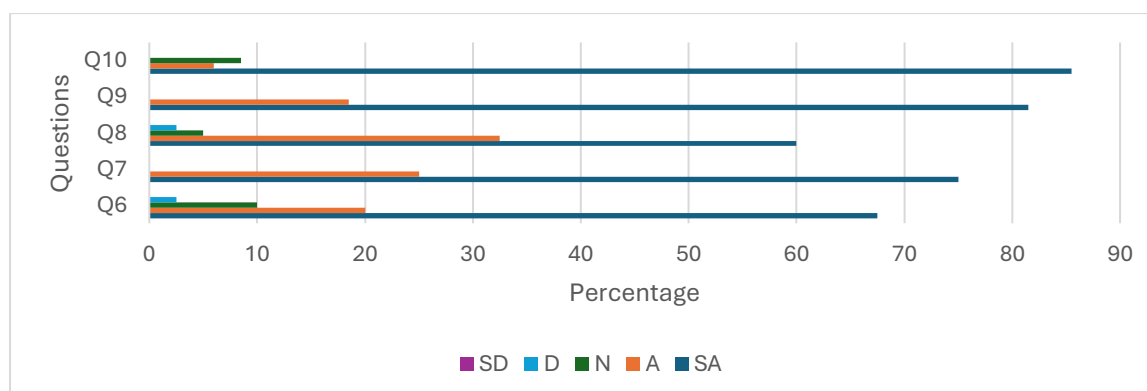


Figure 2. Process of implementing the vak game model using smart floors in physical education, sports, and health learning

Figure 2 shows the implementation of the VAK games using a systematic bright floor. In the first stage, VAK games must be carried out through elaboration to achieve an independent and enjoyable understanding of the material for students (67.5% / strongly agree). In the second stage, the process is confirmation aimed at integrating and absorbing sports knowledge and practice to gain new skills (75% / strongly agree). In the third stage, confirmation, namely helping students apply and expand sports knowledge (60%). Students are also interested in sports lesson practice activities for some materials that use innovative mats (smart floors) (81.5% / strongly

agree). According to the students, VAK games must also be carried out systematically and in the proper sequence in order to help students practice sports properly (85.5% / strongly agree).

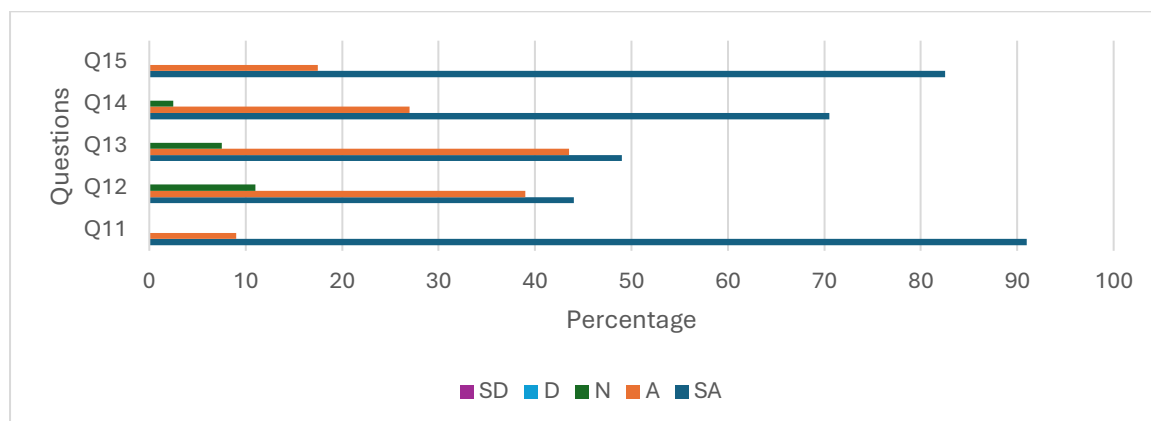


Figure 3. Impact of the implementation of the vak game model using smart floors in physical education, sports, and health learning

Figure 3 illustrates the results of students' perspectives on the need for the VAK game model using Smart Floor related to the impact of implementing this game model on physical, sports and health learning achievements. Stemming from these findings, it was found that 1) VAK games can help students practice sports easily (91% / strongly agree), 2) VAK games using Smart Floor can have an impact on achieving better sports practice scores than before (44% / strongly agree), 3) VAK games using Smart Floor can help students understand sports material comprehensively because the practices carried out are directly related to activities that students like (49% / strongly agree), 4) VAK games are more fun using Smart Floors or equipped with digital technology media (70.5% / strongly agree), and 5) VAK games using Smart Floors can have an impact on better interest in sports practice (82.5% / strongly agree).

Grounded on the essay questionnaire questions, several important answers were found that support the need for the VAK game learning model design using Smart Floor, namely;

1. Games should be varied, including traditional games played conventionally or equipped with technological media such as video and music displays.
2. Some proposed traditional games are *Gobak Sodor*, Fortifications, Hide and Seek, Hopscotch, Bekel Ball, Baseball, Rope Jumping, Clog Races, *Congklak*, and *Cublak-Cublak Suweng*.
3. Traditional games are more fun for students than modern games via smartphone access.

Based on the findings of this needs analysis data, a framework for the design needs of the VAK game using smart floor can be made, namely;

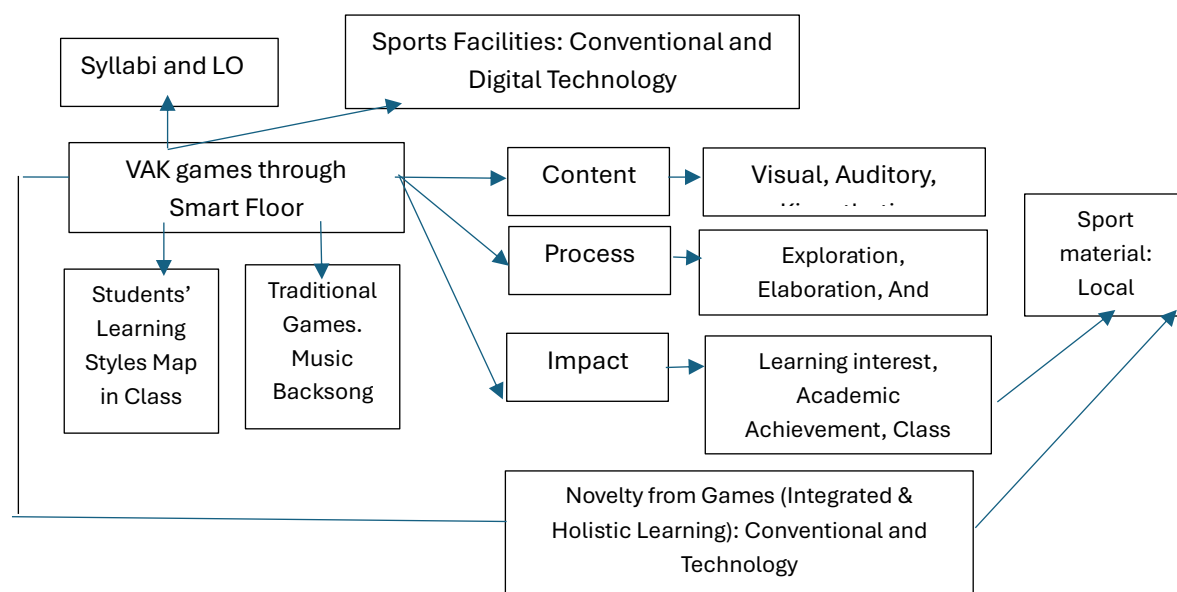


Figure 3. Framework of needs analysis for vak games through smart floor for physical education, sports and health learning in elementary schools

4. Discussion

Grounded in this needs analysis, it was found that students' perspectives were that sports practice is more enjoyable through traditional games because traditional games have audio, visual, and kinesthetic concepts. Some inputs of traditional games that are in accordance with the sports lesson material for grades four and five are *Gobak Sodor*, *Bentengan*, *Petak Umpet*, *Engklek*, *Bola Bekel*, *Bola Kasti*, *Jump Rope*, *Clog Race*, *Congklak*, and *Cublak-Cublak Suweng*. The traditional games used in each sport's learning material can vary for this input. Traditional games are favoured because they are familiar, contain narrative elements, and train cooperation, making them suitable for the characteristics of elementary students. This means that during sports practice, teachers can use several traditional games to implement VAK games using Smart Floors in sports classes.

The results of the data analysis found that the need for VAK games using Smart Floors in learning Physical Education, Sports, and Health for elementary students in Palembang is urgent. The results of the data analysis from the perspective of students and teachers found novelties that were quite relevant to current conditions in the development of science, technology, and changes in the community's social life. This means the designed VAK game must combine holistic learning from conventional (practice) with practice facilities using digital technology, such as Smart Floors and music for background game activities. As we know, technology has become a learning medium that has quite an influence on the world of Education, Society, and the Socio-Cultural Community (Alemayehu Tegegn, 2024; Haleem et al., 2022). The use of technology in physical education learning brings change by integrating digitalisation technology with elements of local wisdom, by strengthening student character (Zhen & Wang, 2024).

Another novelty found from the needs analysis for the design of this VAK game model must be designed according to the map of student learning styles, and the types of games used can

vary according to the needs of the material being taught. Even from the traditional games proposed by students to implement the VAK game model, local wisdom values refer to the development of character education values. This means that this finding illustrates that every design of a learning model must pay attention to the values of character education related to the cultural values of the local community.

This finding also suggests that sports learning for elementary students through games is quite effective. Numerous studies are relevant to this finding. Games improve elementary school students' basic movement skills (Dike et al., 2023). Physical activity can be integrated with local culture, with movements in traditional games, to improve physical fitness (Luo et al., 2023). This means that learning physical activity through traditional games that are integrated with local cultural values and technology can improve students' physical fitness and character (Faghy et al., 2025). Learning models that modify games can be used to facilitate students' basic movement achievements (Kurniawan & Hanief, 2022; Siswanto et al., 2022; Aliriad et al., 2024; Asriasnyah, 2018).

5. Conclusion and Implications

This needs analysis confirms a strong demand for a game-based physical education model that integrates traditional games as the main content, supported by interactive technologies like the Smart Floor. The VAK game model using Smart Floors was created to contain 1) content aspects (audio, visual, and kinesthetic), 2) process aspects (exploration, elaboration, and confirmation), and 3) impact aspects. Stemming from this needs analysis, teachers can even teach local wisdom values related to character education values using traditional games integrated with technology media. While the aspect of digital technology facilities is more applied as a complement in explaining game instructions through watching animated videos. Teachers can also use songs to enliven the implementation of the game. The VAK game model must also be in accordance with the learning style of the student's personality and the characteristics of elementary students.

The research results have implications, including 1) practical implications: these findings guide the design of a prototype of a VAK game model based on Smart Floor and specific traditional games like *Gobak Sodor*. This means that teachers must understand that in designing learning models for elementary students, they must pay attention to the character of elementary school-age students, the needs of achieving learning objectives, scientific developments in education, government policy developments and technological advances in the world of education. 2) Theoretical implication: This research provides an initial framework for developing a physical education learning model in elementary schools that integrates learning styles, technology, and local wisdom. The schools can facilitate the development of conventional and technological sports teaching and learning facilities.

6. Limitation

This research is still limited to analysing the needs for developing the VAK game model using Smart Floors in Physical Education, Sports, and Health learning. Therefore, the results of this finding can be used as a basis for designing or creating a VAK game model using Smart Floors for Physical Education, Sports, and Health learning. Therefore, this research can still be continued for research and development of the VAK game model, and the influence of the VAK game on the value of sports learning.

Credit authorship contribution statement

The first author creates a research proposal. The second and third authors collect and analyse data. The fourth and fifth authors generate a research report and publish the results.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Ethical Declaration

All participants provided informed consent before their involvement in the study. They were informed about the study's purpose, procedures, and their right to withdraw at any time without consequence.

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