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Context, Audit, and Index (CAI) Model Approach in Determining The Safety of Sports Infrastructure in Malaysia Schools

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Abstract:
Background: *School is an entity under the management of the Ministry of Education Malaysia and should have a model of systematically coordinated audit reporting the safety of sports infrastructure in schools.*
Objective: *To determine the level of sports infrastructure in schools based on safety using School Sports Safety Audit Tools (3SAT) based on Context, Audit, and Index (CAI) model approach.*
Method: *A descriptive method and comprehensive survey designs were employed. Data were collected through observations at 70 primary and 47 secondary schools of urban and rural areas, selected through random sampling technique.*
Results: *The sports infrastructure has a very high to a high level of readiness context in structure, location, size, uses and functionality. The analysis of audit data showed that the overall safety of sports infrastructure (physical and management) was a high level for all schools except rural secondary schools that achieved a moderate level of court safety.*
Conclusion: *Overall, the safety index of sports infrastructure was at a high level and labelled as green indicating a low risk of accidents. The study implies that 3SAT, a CAI model approach can support the schools to record and report on sports infrastructure safety. The audit report could also be submitted periodically to the Malaysia Ministry of Education and to be accessed by parents and the community to authenticate their confidence in the safety of infrastructure involving teaching and learning activities of students in schools.*
Keywords: *Sports safety model, sports infrastructure, sports context, audit reports, sports safety index.*

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I. Introduction

Schools are mandatory to comply and enforce legislation and regulations for enhancing safety behaviour and providing a safer environment for the children. In Malaysia, schoolchildren spend a significant amount of time (168 days; 1344 hours in an academic year calendar) and interact with objects including the sports infrastructure. Injury prevention and safety promotion are thus crucial towards ensuring the safety of the children. Sports infrastructure in schools refers to facilities such as sports stores, fields, courts, halls, and sports equipment that involve systems and services in conducting teaching and learning activities in Physical Education, co-curriculum and sports. On one hand, good infrastructure can stimulate teachers and students to use a variety of appropriate facilities to help them succeed in the teaching and learning process [1]. On the other hand, poorly managed infrastructure which is lacking proper monitoring, inspection and maintenance could pose a safety threat to them.

Therefore, schools should prioritize safety aspects by being responsible for preventing and addressing the risk of accidents related to infrastructure involved in Physical Education, co-curricular and sports activities. The Ministry of Education Malaysia (MOE) is very concerned about the safety of students while conducting Physical Education, co-curricular, and sports activities. MOE has issued several Professional Circular Letters namely SPI No.1/1995: Personal safety of students during the teaching of Physical Education and Health Education, co-curricular and sports activities inside and outside the school compound [2], SPI No.9/2000: Guide to student personal safety during the teaching of Physical Education and Health Education, co-curricular and sports activities inside and outside the school compound [3] and MOE SPI No.5/2016: Safety guide during the teaching of Physical Education and Health Education, co-curricular and sports activities inside and outside the school [4].

The roles that school need to give priority and attention based on the content of the SPI include:

a. Conduct Physical Education, co-curriculum or sports program activities based on a plan that has been set based on the correct processes and procedures.
b. Identify Physical Education, co-curriculum or sports program activities that are appropriate and capable of the physical and fitness level of students.
c. Inspect the sports areas and equipment before Physical Education, co-curriculum or sports program activities are implemented and during the implementation.
d. Provide understanding and awareness to students about the importance of personal safety while attending Physical Education, co-curriculum or sports program activities.
e. Ensure that students have fully dressed in sports attire (according to school rules) during Physical Education, co-curriculum or sports program activities.
f. Inform parents or guardians about Physical Education, co-curriculum or sports program activities by obtaining a letter of permission from them.
g. Observe and monitor the movement of students during the implementation of Physical Education, co-curriculum or sports program activities.
h. Ensure that the students comply with safety instructions while attending Physical Education, co-curriculum or sports program activities.

The roles imply that the school is not only responsible in the event of an accident, but also responsible for preventing accidents. In this regard, the school also plays a role in providing safe and conducive infrastructure for the teaching and learning process. In 2002, MOE submitted a Safe School Policy to increase the understanding and appreciation of school community that safety should be made the main agenda in all aspects of education [5]. Therefore, the management and school leaders are responsible for monitoring and inspecting infrastructure to control and reduce the possibility of accidents among students.

II. Problem Statement

News of accident incidents occurring in the school compound is often an issue and spread through the mass media. Among them, an accident related to health complications that occurred in April 2010 in which a transition class male student died due to heart complications while participating in his school's annual sports event in Bukit Mertajam [6]. The incident also happened at a primary school in Merapoh when a Year Six male student died due to high blood pressure and heart problems while participating in an athletics tournament in 2015 [7]. In April 2016, Malaysians were informed of an accident involving a Year One school student who died because he was believed to have been bitten by a snake while playing with friends at the school compound [8]and followed by several other incidents. Similarly, there is a news of the accident incident of a student died as a result of being hit by the goal post while playing ball in the school area [9]. In 2019, a Form Four student collapsed and lost consciousness while participating in a running event during the annual sports day, and died a few minutes after arriving at the hospital[10].

Recently, there is news about a 16-year-old student who died after joining cross-country training at school [11]. Subsequently, a Form Four student who was injured in the left eye due to being stabbed by an arrow accidentally released by his friend while undergoing archery training at the school field [12]. According to the witnesses, during the incident, there were no monitoring from the teachers and the involved students had taken archery equipment at the store on their own to perform archery training to represent the district in the State Schools Sports Council level competition. The accident incident has received unpleasant reactions, especially on the part of parents whose children are still in school because it is terrified that such incidents could happen to their children. The Ministry of Education Malaysia is informed of the incident and asked the school administration to make an audit report on the state of infrastructure from safety aspects [13].

The safety aspects of infrastructure need to be given serious attention by the school, especially when conducting Physical Education, co-curriculum and sports program activities. Every teacher involved in such activities or programs must take safety measures by taking into account the guidelines and instructions in the Professional Circular Letter of the Ministry of Education Malaysia related to the safety of students in schools. Teachers also need to ensure that students follow the instructions and guidelines in the use and management of sports equipment.

Previous studies by Abdullah et al. [14] found that the quality of administrative management on sports safety in primary and secondary schools of urban and rural areas was at an excellent level. Similarly, the compliance of teachers' practices to sports safety in primary and secondary schools of urban and rural areas was at a very high level. There was no significant difference in the quality of administrative management and compliance of teachers' practices on sports safety in primary and secondary schools between urban and rural areas. There was a very strong and significant relationship between the quality of administrative management with the compliance of teachers' practices on sports safety in primary and secondary schools of urban and rural areas. The implication of the study provides input and indicators that good management and compliance of practices in sports activities are guaranteed when schools give attention and take action on sports safety issues

based on Professional Circular Letters, Safe School Policy, and Hygiene, Health and Safety programs according to standard operating procedures.

The findings of their study illustrated that the quality of administrative management and teacher practice on sports safety was very good and ranked as high. Preferably the school should always monitor to ensure the safety of infrastructure that is at risk of student accidents, especially in Physical Education, co-curriculum, and sports activities. Schools need to have specific and standard measuring instruments in conducting inspections or audits and monitoring to determine the level of safety so that the risk of accidents can be prevented and controlled. Referring to the letter released and under the supervision of Johor Bahru District Education Office the school was instructed to make a safety audit report on the state of infrastructure, namely school sports facilities and equipment [15]. Accordingly, the Chairman of the National Institute of Occupational Safety and Health (NIOSH) has recommended that all schools conduct safety audits at least once every two years to identify any weaknesses to improve for accident prevention [16]. The President of the National Parent Teacher Association (PTA) Consensus Council also reminded the school to take action to improve the infrastructure from time to time and to have safety records and weekly and annual reports periodically [17].

School is an entity under the management of the Ministry of Education Malaysia and should have a system of a systematically coordinated audit to report the safety of sports infrastructure in schools. However, it is found that schools do not have a safety report model with standard or specific measuring tools or instruments to conduct safety audits. Consequently, to provide input and indicators to identify the safety level and accident risk on the state of sports infrastructure in schools. Similar audit tools have been developed such as Physical Activity Campus Environmental Support [18], MAPS Global [19], and TCOPPE School Environmental Audit Tool [20], but none for assessing sports infrastructures. Hence, an audit tool using the Context, Audit, and Index model approach by Jani et al. [21] was developed. The model is an evaluation instrument that provides input from the aspects of context, audit and index to identify the level of safety of sports infrastructure in schools. Hence, the purpose of this study was to implement CAI model approach in determining the safety of sports infrastructure in schools. The audit report can be periodically tabled to the Ministry of Education Malaysia. The audit report can also be accessed by parents and the community to authenticate their confidence in the safety of infrastructure involving teaching and learning activities of students in schools.

III. Objectives

The objectives of this study are as follows:

a. To analyse the context level on the aspect of sports infrastructure readiness in urban and rural primary and secondary schools.
b. To audit the safety level of sports infrastructure in urban and rural primary and secondary schools.
c. To determine the safety index of sports infrastructure in urban and rural primary and secondary schools.

IV. Methodology

The study was a descriptive design, involving both comprehensive survey and observation methods. The survey method was administered using structured questions. The observation was guided by a checklist containing evaluation rubric items based on Context, Audit, and Index (CAI) approach model [21]. The study samples were randomly selected among primary and secondary schools. The researchers chose the urban study site at Bangsar/Pudu zone in the Federal Territory of Kuala Lumpur while the rural site was set in the districts of Batang Padang and Mualim, Perak. The selection was based on procurement to balance the number of sample sizes as well as the diversity of infrastructure environment in terms of urban and rural locations. The total number of primary schools was 70 (26 in urban and 44 in rural) while the secondary schools was 47 (34 in urban and 13 in rural).

3SAT, the research instrument is a school's sports safety audit tool developed by Jani et al. (2020) with an excellent level of validity was administered in this study. 3SAT contains structured questions on the context and audit of school infrastructure based on 1 to 5 scale evaluation rubrics on the safety of Sports Stores/Sports Management Rooms, Fields, Open Courts, Roofed Open Halls, and Indoor Halls. Data obtained from the questionnaire and audit process were analysed descriptively to identify the safety index of sports infrastructure in the schools. The expert panel's agreement on the validity of the SSAT was 91.70%. The reliability in measuring safety in Sports Stores/Sports Management Rooms (α = .863), Field (α = .842), Open Courts (α = .816), Roofed Open Halls (α = .738), and Indoor Halls (α = .647) was ranked as good and consistent.

The process of data collection based on the CAI model starts by analysing the context level on the aspect of sports infrastructure readiness in schools. The readiness aspect contains structured questions about the structure, location, size, use and functionality of the infrastructure. The context level based on a scale of values 1 to 5 was transformed into percentage values. Next, the researchers conducted a sports infrastructure safety audit involving physical safety and management aspects through observation method based on evaluation rubrics 1 to 5 was transformed into percentage values. Data obtained from context and audit processes were

analysed statistically descriptively to determine the safety index of sports infrastructure in schools. The sports infrastructure safety index was determined based on the evaluation percentage adjusted to the level of infrastructure safety to determine the safety indicators labelled with colour. The sports infrastructure safety index is presented in Table 1.

Table no 1 Sports Infrastructure Safety Index in Schools

Evaluation Percentage	Safety Level	Safety Indicator	Colour
80.1 - 100	Very High	The risk of accidents is very low	Blue
60.1 - 80	High	The risk of accidents is low	Green
40.1 - 60	Moderate	The risk of accidents is moderate	Yellow
20.1 - 40	Low	The risk of accidents is high	Orange
1 - 20	Very Low	The risk of accidents is very high	Red

Jani et al. [21]

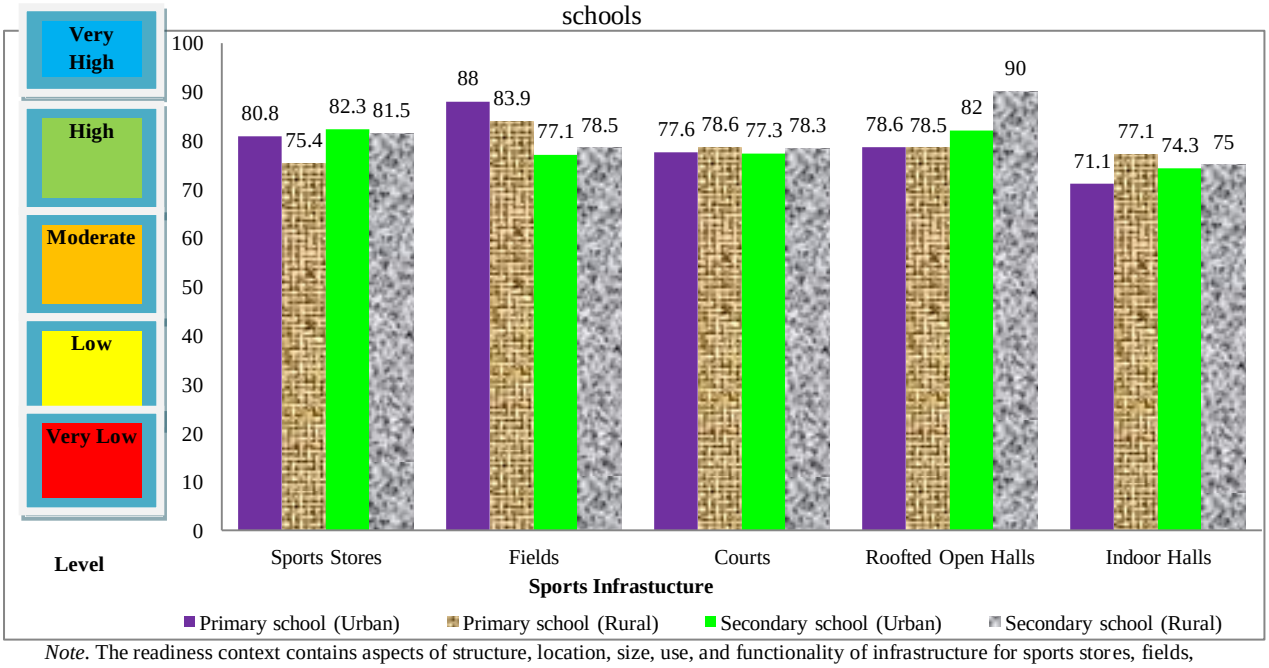
V. Results and Discussion

In this section, the researchers report the findings of the study descriptively for the context level in terms of sports infrastructure readiness in urban and rural primary and secondary schools. Next, the researchers provide an evaluation of the audit results on the level of physical and management safety of sports infrastructure in urban and rural primary and secondary schools. Then the safety index of sports infrastructure in both urban and rural primary and secondary schools was determined.

Analysis of Sports Infrastructure Context in Urban and Rural Primary and Secondary Schools

The sports infrastructure were Sports Stores/Sports Management Rooms, Fields, Open Courts, Roofed Open Halls and Indoor Halls. The aspect of context contains readiness information i.e. structure, location, size, use and functionality of the infrastructure. The level of context of sports infrastructure readiness in urban and rural primary and secondary schools as depicted in Table 2.

Table no 2 Level of the context of sports infrastructure readiness in urban and rural primary and secondary schools



Note. The readiness context contains aspects of structure, location, size, use, and functionality of infrastructure for sports stores, fields, courts, roofed open-halls and indoor-halls in urban and rural primary and secondary schools.

Overall, the context of sports infrastructure readiness for urban and rural primary and secondary schools was at high and very high levels. The context of infrastructure readiness which was at a very high level includes sports stores, fields and roofed open hall. The very high level in the context of sports stores readiness was achieved by urban primary schools (80.8%), urban secondary schools (82.3%) and rural areas (81.5%). The very high level of field readiness context was achieved by urban (88.0%) and rural (83.9%) primary schools. Both urban (82.0%) and rural (90.0%) secondary schools achieved a very high level of context for the readiness of roofed open-halls. Meanwhile, all schools achieved a high level with a value range between 71.1% to 78.6% in the context of readiness for courts and indoor-halls infrastructure.

The study also found that the sports infrastructure in the schools has a high level of readiness context and very high in terms of structure, location, size, use, and functionality. Based on observations, the structural aspects of the sports store were found to be sturdy, grilled and locked. On the field structure, 95% of the schools have dense, short grass and few thorny plants. All the schools have a cemented court structure and a covered open hall. The structure of the indoor hall is a compact concrete building with either parquet or cement floor with no protuberant crack. **I**n terms of location, all sports infrastructure is within the school compound, close to sports activities venues with an easy and safe route. In terms of size, 80% of the schools have a sports store which has medium to large space that is between 9 x 9 meters (almost half the size of the classroom). All the schools have a medium to a large field of approximately 100 meters x 200 meters that can accommodate a 200-meter athletic race track. All the schools have the court size for a volleyball or basketball game. The same goes for the size of the roofed open-hall that can accommodate a volleyball or basketball court. The size of the indoor-hall in the schools could mostly accommodate two badminton or "sepak takraw" (kick volleyball, a native traditional game in South-East Asia countries) courts.

The sports infrastructures in all schools are used for Physical Education classes and co-curricular activities. They are also used for sports competitions, sports training and other related sports activities. Infrastructure such as sports stores, fields, and courts function every day (five times a week) during the school session. The roofed open-halls and indoor-halls function two or three times a week during school sessions. 98% of the schools surveyed do not share fields and courts with outside organizations. Information on the readiness context of sports infrastructure in the schools has given the impression that the schools have provided well and safe infrastructure for the use of students. The schools' action on the matter complies with the Occupational Safety and Health Act 1994 (Act 514) in Part IV, Section 15(2) in subsection e) [22]. The subsection requires employers to provide and maintain a work environment such as physical buildings and structures in good condition and provide facilities such as safe teaching and learning areas and spaces.

The Safety Audit of Sports Infrastructure in Urban and Rural Primary and Secondary Schools

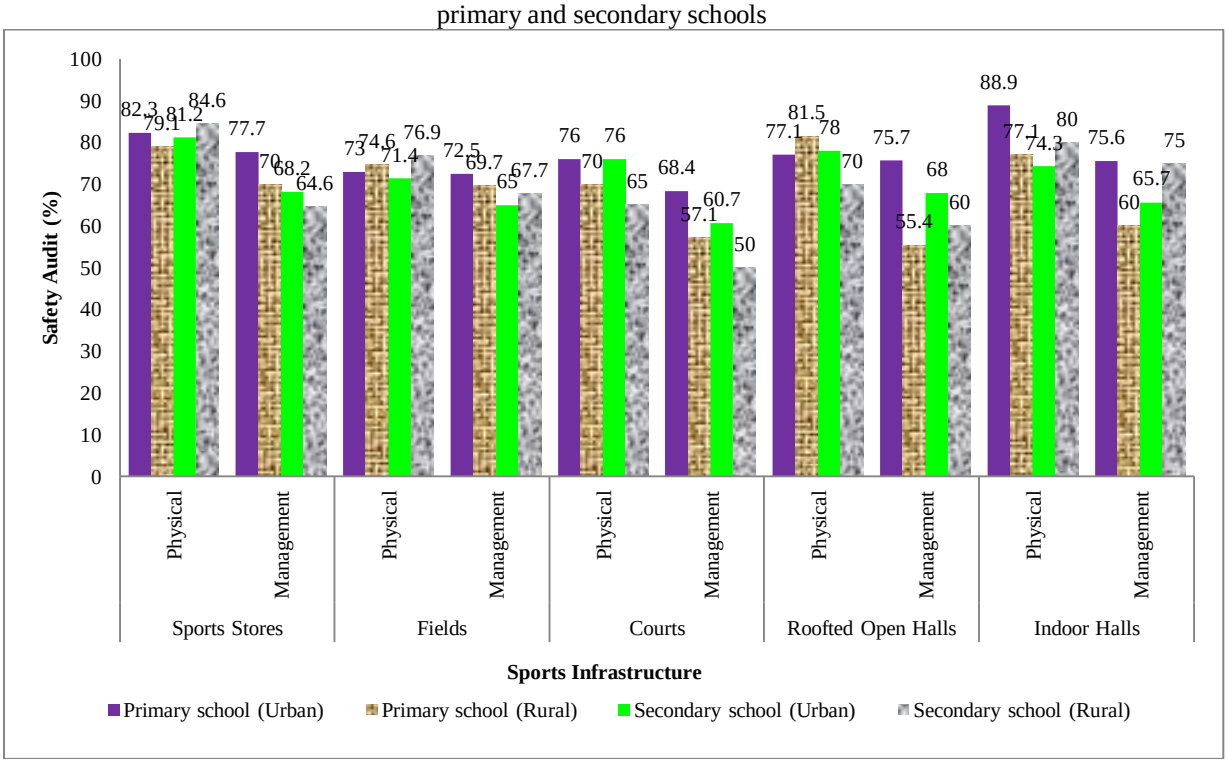
The audited sports infrastructure refers to both physical and management safety. The physical safety of the sports infrastructure is audited based on environmental, control, and information aspects. Meanwhile, sports infrastructure management safety is audited based on the aspect of maintenance and record management. As a result of the audit data analysis, the overall sports infrastructure safety was found at a high level for all the schools. Only rural secondary schools achieved a moderate level (57.5%) for court safety (Table 3).

Table no 3 Percentage and level of sports infrastructure safety in urban and rural primary and secondary schools

	Sports Infrastructure Safety (%)				
School Types	Sports Stores	Fields	Courts	Open-Halls	Indoor-Halls
Primary School (Urban)	77.7	72.5	68.4	75.7	75.6
Level	High	High	High	High	High
Primary School (Rural)	74.5	72.2	63.6	68.5	68.5
Level	High	High	High	High	High
Secondary School (Urban)	74.7	68.2	68.3	73	70
Level	High	High	High	High	High
Secondary School (Rural)	74.6	72.3	57.5	65	77.5
Level	High	High	Moderate	High	High

Table 4 depicts in detail the level of sports infrastructure safety from the physical and management aspects in urban and rural primary and secondary schools. The percentage of physical safety audits was at a higher level than the management of sports stores, fields, courts, roofed open halls and indoor halls in urban and rural primary and secondary schools. All the schools have achieved very high and high levels of physical safety compared to management. The rural primary and secondary schools have reached a moderate level for the management safety of court and roofed open hall. Rural secondary schools achieved the highest percentage for the physical safety of sports stores (84.6%) and fields (76.9%) compared to other schools. Urban primary schools achieved the highest percentage of indoor-hall physical safety (88.9%) and rural primary schools achieved the highest percentage (81.5%) for roofed open-hall physical safety. For the physical safety of the court, the urban primary and secondary schools performed better (76.0%) compared to the rural primary and secondary schools. Based on the percentage of physical safety achievements of sports infrastructure, it is exemplified that the schools have taken responsibility in caring for the environment, making controls and providing information for sports infrastructure to the best of their ability. The management infrastructure safety audit was evaluated from the aspects of maintenance and management of records on sports stores, fields, courts, roofed open-halls, and indoor-halls in both urban and rural primary and secondary schools.

Table no 4 Audit of the level of physical and management safety of sports infrastructure in urban and rural primary and secondary schools



Note. The physical infrastructure safety audit was evaluated based on environmental, control and information aspects.

As the example of audit for the environmental safety aspect in sports stores, the school has arranged the equipment neatly, according to the category/type of sport and labelled correctly. The physical floor of the sports store was dry, clean and not cracked. The sports store has good ventilation flow system and does not stink. The audited sports store obtains sufficient lighting from lights, windows, doors with bright wall colour textures. The temperature in the sports store is not hot because it has a functioning fan, ample space and suitable roof height. From the control aspect, the school has ensured that the doors and windows are grilled and locked. The movement path inside the store is comfortable, i.e. no equipment prevents the movement path in and out. The electrical wiring is in order and good condition. First aid kits containing a complete set of essential medicines are provided and easily accessible. The school also provided complete information such as displaying updated general safety statements, providing safety policies/rules for conducting sports activities and Physical Education following the proper guidelines. A comprehensive guide to the use of equipment was displayed and labelled completely. The sports store equipped with an easy-to-see emergency route chart/plan to clearly show route exit directions.

The example of audit for the environmental safety aspect of the fields, courts, roofed open halls and indoor halls are almost the same in terms of the position of available equipment, space/size, floor surface and drainage system. Overall, the school has arranged the available sports equipment such as football goal posts, netball, volleyball and basketball in the correct position according to the game. The school has positioned the courts so that they do not face the sunrise, sunset or the glare of the lights. In terms of space/size of sports activities, it is found that it can accommodate a large number of students, namely three or four classes at a time for Physical Education or sports activities. The audited sports infrastructure has flat floor/field surface and does not bulge due to the drainage system to enable smooth flow water into the drain. The distance of the drain from the sports activity area is sufficient, exceeding 1 meter and covered with iron strips. The surroundings of the infrastructure studied were clean and away from the bush.

The management safety aspect audited was about the maintenance and management of sports infrastructure records. The achievement of audit results for the management safety aspects of the schools was at a high and moderate level. As a result of the total percentage of audited management aspects for all sports infrastructure, it was found that urban primary schools achieved the highest level (68.5%), followed by urban secondary schools (65.5%), rural secondary schools (63.5%), and rural primary schools (62.5%). Entirely the schools have a high level of sports stores safety management. The schools had made maintenance such as repairing damage to sports equipment, hygiene of sports equipment and insect control. The school also kept the

records such as the receipt of new sports equipment, stock checking, borrowing records, maintenance, disposal and loss of sports equipment.

Rural primary schools achieved a moderate level in court safety management, roofed open halls and indoor halls. Rural secondary schools scored a moderate level of safety management of courts and roofed open-halls. Based on the rubric value, the maintenance of sports equipment was not done on schedule and the frequency was uncertain. The school has provided report documents but not updated.

Analysis of the physical safety audit data and sports infrastructure management demonstrated that schools are very concerned about the safety aspects of sports infrastructure in their schools. The schools have managed the safety climate in sports based on the Professional Circular Letter and Safe School Policy.

Sports Infrastructure Safety Index in Urban and Rural Primary and Secondary Schools

Safety index data is determined based on mean readiness context and infrastructure safety audits. Sports infrastructure safety index is calculated based on the percentage of evaluation adjusted to the safety level to determine the colour-adjusted safety indicators. The safety index of sports infrastructure in urban and rural primary and secondary schools is described in Table 5. The sports infrastructure safety index in the schools was at a high level. The index provides an indicator that all sports infrastructure has a low risk of accidents and is labelled as green. The results of this study illustrated that both urban and rural primary and secondary schools have provided a safe and conducive infrastructure for the teaching and learning process. Good sports infrastructure stimulates teachers to use various appropriate facilities to help them succeed in the teaching and learning process in Physical Education, co-curriculum and sports activities.

Table no 5 Sports infrastructure safety index in primary and secondary schools

School Types	Sports Infrastructure Safety Index (%)				
	Sports Stores	Fields	Courts	Open Halls	Indoor Halls
Primary School (N=70)					
Mean Safety Index	77.1	79.1	72.0	75.3	73.1
Secondary School (N=47)					
Mean Safety Index	78.2	74.0	70.3	77.5	74.1
Safety Level	High	High	High	High	High
Safety Indicator	Safe	Safe	Safe	Safe	Safe
Color Zone	Green	Green	Green	Green	Green

Note: The safety index is the mean percentage of readiness context and sports infrastructure safety audit adjusted to the level to determine colour-adjusted safety indicators.

Therefore, the safety level of sports infrastructure can be determined through a standard 3 SAT CAI model evaluation tools to provide input of context, audit and index. The model is looked-for by schools so that systematically coordinated sports infrastructure safety audit report can be tabled to stakeholders such as the Ministry of Education Malaysia, the community and parents of school children.

VI. Conclusion

Based on the descriptive analysis, the sports infrastructure in the schools has a very high level of readiness context in terms of structure, location, size, use, and functionality. Overall, the analysis of audit data displayed that safety (physical and management) of sports infrastructure was at a high level for all schools. Only rural secondary schools achieved moderate levels of court safety. All the schools have achieved very high and high levels of physical safety compared to management. All rural primary and secondary schools have reached a moderate level for the safety management of courts and roofed open-halls. Next, the safety index of sports infrastructure in the schools was at a high level. The index provides an indicator that all sports infrastructure has a low risk of accidents and are labelled in green. The 3SAT a CAI (Context, Audit, Index) model approach provides input from the aspects of context, audit, and index to identify the level of sports infrastructure safety in schools. Besides monitoring the safety of sports infrastructure in schools, it ultimately helps to hinder future accident from happening. The audit report could periodically be tabled to the Ministry of Education Malaysia and to be accessed by parents and the community to authenticate their confidence in the safety of infrastructure involving teaching and learning activities of students in schools.

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