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Preliminary Study: Reliability and Validity of CFM-1 Form as Physical Literacy Assessment Instrument

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Abstract

Context: This study aimed to determine reliability and validity of newly developed physical literacy assessment instrument named CFM-1. For the inter-tester reliability sixty two respondents (37 males, 25 females) aged 21.97 ± 0.54 years old with 2 years basics sports science background voluntarily participated. All respondents were given detailed explanations on CFM-1 instrument, and introductory on physical literacy using the online module developed. Respondents were shown videos of similar action (throwing) but from five different children aged 5-6 years old. Upon completing the viewing, respondents were then asked to rate the performance of the child in the video using CFM-1 instrument. Similar protocol was repeated with all the respondents for the second time. CFM-1 rating given by the respondents were then recorded and analyzed. Validity was determined based on qualitative comparisons with characteristics of physical literacy described in definition of term accepted worldwide. Results showed for reliability, Cronbach's Alpha α was 0.767 for motivation, 0.524 for knowledge, 5.733E-14 for confidence, 0.475 for understanding and 0.712 for overall physical competence. For physical competence Likert Scale of 1-5, reliability Cronbach's Alpha α was 0.826. The CFM-1 instruments can be said as reliable to be used for physical literacy assessment, with good reliability observed for all psychomotor and affective domain of learning involved, but some modification in term of the method of testing may need to be clarified and adjusted (especially for the cognitive part of the test - knowledge and understanding). Overall CFM-1 is valid and has an acceptable range of reliability level as an instrument for physical literacy.

Keywords: *physical literacy, childhood, adulthood, assessment, reliability*

Introduction

Physical literacy is not a new concept. In fact, physical literacy should be considered as the essence of physical education for all age groups. Widely accepted definition of physical literacy consist the element of motivation, knowledge, confidence, understanding and physical competence when performing any physical activity or exercises¹⁻⁶.

An individual can be said as physically literate when they have the motivation to consistently pursue physical activity. At the same time that motivation is supported by the know how or knowledge, which will ensure the activity perform is safe, correct technique and effective. With the knowledge, then it will contributes towards the confidence in doing the skill and understanding on why it should be done. With all those four elements, then it comes to the psychomotor and physical ability in ensuring the movement can be performed with competence. When an individual possess all of this, the assumption is that they will be able to be active for life. This is physical literacy by definition.

Based on those definition, one can actually start to assess and monitor their physical literacy level. There are several studies that have quantify the reliability

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and validity of instruments for physical literacy assessment⁷⁻¹². However, the number of studies currently still limited in numbers, with many more improvements can be done with all the instruments.

One of the limitation of the currently available instruments is that it is limited in term of usage, where it can only be used with specific types of movement and for certain age group only. This limitation may be due to the fact that most of the instruments accept the understanding that physical literacy is only for children, at the beginning phase of their physical growth.

For the purpose of this study, the accepted understanding is that physical literacy is something that should not be limited only to early childhood¹³. Thus the instrument developed and tested is actually to be used from childhood up to adulthood. One part of physical literacy is physical competence, and physical competence in any movement or activity will have their progress or digress period. Can we said that an older adult which used to be competitive athletes but now unable to even perform simple hop as still physically literate?

Physical literacy also should not be limited only to fundamental movement skills (FMS) such as running, jumping, hopping and many more. But it should be dependable on what is the goal or purpose of the movement or activity.

For these reasons, a new instrument has been developed with code named CFM-1. In order to determine it reliability and validity, this study was conducted.

Method

Experimental Approach to the Problem:

Reliability: The test-retest method was used to determine the inter-tester reliability of the CFM-1 instrument.

Validity: Validity was determined based on qualitative comparisons with characteristics of physical literacy described in definition of term accepted worldwide.

Penilaian Celik Fizikal Malaysia (CFM1)

NAMA PENUH / FULL NAME
TELEFON / PHONE
EMAIL
TARIKH LAHIR / DATE OF BIRTH
TARIKH UJIAN / TEST DATE
TINGGI / HEIGHT (cm)
BERAT / WEIGHT (kg)
JENIS UJIAN FIZIKAL / TYPE OF PHYSICAL TEST

MOTIVASI / MOTIVATION



PENGETAHUAN / KNOWLEDGE




KEYAKINAN / CONFIDENCE



KEFAHAMAN / UNDERSTANDING



KOMPETENSI FIZIKAL / PHYSICAL COMPETENCE





BAHAYA
DANGER

CUBA LAGI
TRY AGAIN

BOLEHLAH
ACCEPTABLE

BAIK
GOOD

HEBATNYA!
AWESOME!

PENILAIAN CELIK FIZIKAL MALAYSIA (CFM1)

NAMA PENUH / FULL NAME

TELEFON / PHONE

EMAIL

TARIKH LAHIR / DATE OF BIRTH

TARIKH UJIAN / TEST DATE

TINGGI / HEIGHT (cm)

BERAT / WEIGHT (kg)

JENIS UJIAN FIZIKAL / TYPE OF PHYSICAL TEST

MOTIVASI / MOTIVATION

PENGETAHUAN / KNOWLEDGE

KEYAKINAN / CONFIDENCE

KEFAHAMAN / UNDERSTANDING


Motivasi: Peserta kelihatan (visual) dan mengatakan (verbal) bahawa mereka amat bersemangat/bermotivasi mahu melakukan lakuan / pergerakan berkenaan.

Pengetahuan: Peserta tahu bagaimana untuk melakukan lakuan atau pergerakan tanpa sebarang panduan kecuali dengan melihat contoh lakuan.

Keyakinan: Peserta memaklumkan tanpa paksaan dan tanpa ragu-ragu bahawa mereka yakin untuk melakukannya.

Kefahaman: Peserta faham objektif lakuan berdasarkan pernyataan verbal mereka dan cubaan/kemampuan mereka melaksanakan arahan lakuan/pergerakan hingga selesai.

KOMPETENSI FIZIKAL / PHYSICAL COMPETENCE



BAHAYA
DANGER

CUBA LAGI
TRY AGAIN

BOLEHLAH
ACCEPTABLE

BAIK
GOOD

HEBATNYA!
AWESOME!

Subjects: Sixty two respondents aged 21.97 ± 0.54 years old with 2 years basics sports science background voluntarily participated. Out of the 62 respondents, 37 were male. All participants were still active in sports participation either recreationally as an athlete or in coaching positions (personal trainer / assistant sports coach etc).

Instrument: The newly developed physical literacy assessment form name CFM-1 (dual English and Malay language) and Malay language physical literacy module¹⁴ were used. Five videos recorded by the researcher's showing actual overhead ball throwing action by children aged 5-6 years old were used together with the CFM-1 form. The video also includes the verbal communication process happening between the children and the instructors (researchers' team).

How to use CFM-1:

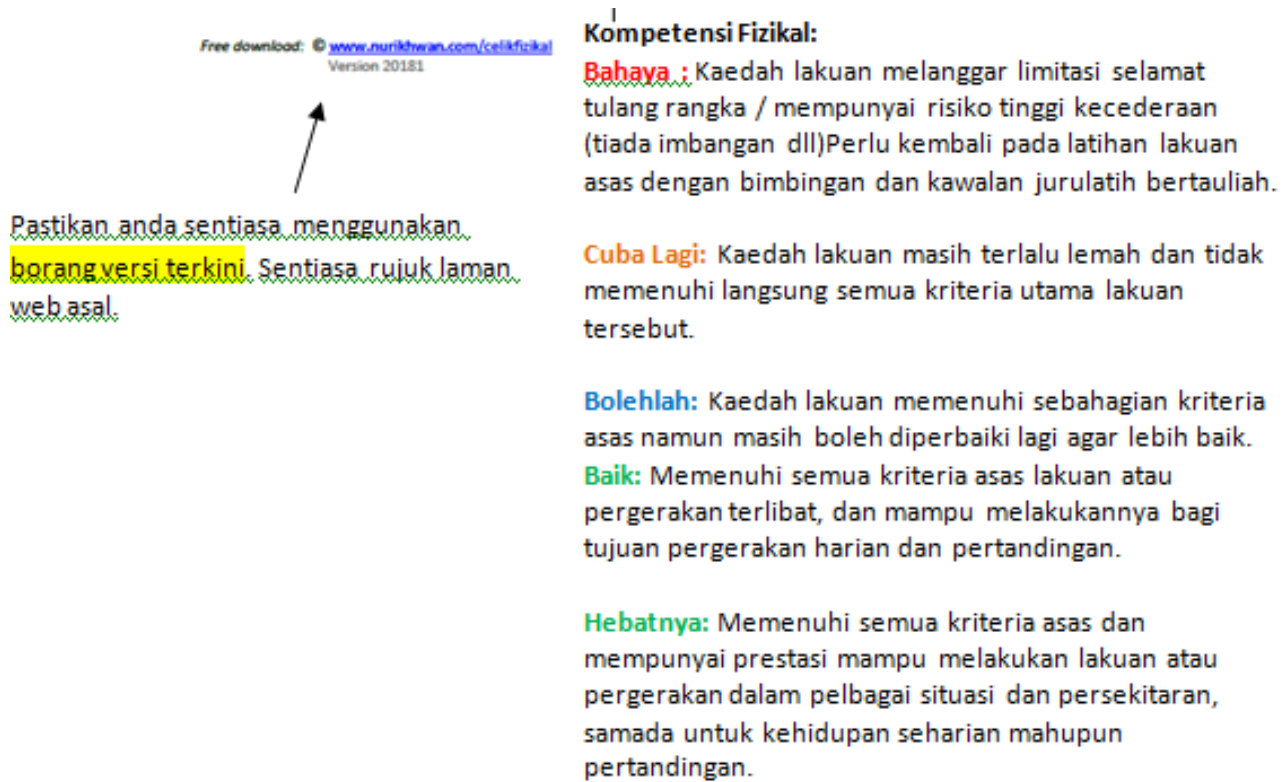


Figure 1: On the left is the original CFM-1 form, and on the right is the CFM-1 form with usage instructions.

Procedures: For the reliability assessment, all respondents were given detailed explanations on CFM-1 instrument, and introductory on physical literacy using the online module developed. The respondents were then given the opportunity to ask any questions pertaining to their understanding on the explanations. After all respondents confirms their understandings, they were then shown videos of similar action (overhead ball throwing) but from five different children aged 5-6 years old. Upon completing the viewing, respondents were then asked to rate the performance of the child in the video using CFM-1 instrument. Similar protocol was repeated with all the respondents for the second time within 15 days time interval. CFM-1 rating given by the respondents in both occasions were then recorded and analyzed.

Ball throwing action: General guidelines given to all respondent is that the rule of thumb for overhead ball throwing is the success of the child to throw the ball towards the next person waiting to catch it in front of them. Second to that, an excellent throw will means the ball reach the intended destination and person with appropriate ball speed and target (within range direct to

hand for easy catch). Thirdly, the mechanics of throwing performance should not violate any proper biomechanics of movement in relation to musculoskeletal function and form. And fourthly, the most excellent throw should incorporated whole body motion indication transfer of force direct from the ground (ground reaction force) towards the throwing hand.

Validity was only determined based on qualitative comparisons with characteristics of physical literacy described in definition of term accepted worldwide^{1,4,6,8,15}.

Data Analysis: The CFM-1 utilized the thumbs-up and thumbs down icon for five overall assessment related to motivation, knowledge, confidence, understanding and physical competence. More comprehensive ratings on physical competence were also asked using five smiley faces depicting five qualitative ratings, which were then assigned into Likert Scale rating system. Figure 2 indicates how the qualitative assessment icons be made into quantitative values. All quantitative values were then recorded in a Microsoft Excel sheet for further statistical analysis.








Qualitative Icon	Quantitative Ratings	Qualitative Respond	
	2 marks	Yes.	
	1 marks	No.	
			Likert Scale
	1 marks	Danger	Strongly disagree with the ability to perform the action safely and effectively.
	2 marks	Try Again	Disagree with the ability to perform the action safely and effectively.
	3 marks	Acceptable	Slightly Disagree with the ability to perform the action safely and effectively.
	4 marks	Good	Agree dengan with the ability to perform the action safely and effectively.
	5 marks	Awesome!	Strongly agree with the ability to perform the action safely and effectively.

Figure 2. Marking system for CFM-1 form. Qualitative ratings descriptors with their respective quantitative ratings

Statistical Analysis: Means and standard deviations were used to represent centrality and spread of data for all performance measures. The intra-class correlation (ICC) one-way random analysis was used to determine the inter-rater reliability when performing assessment using CFM-1 form together with Cronbach's Alpha to measure internal consistency between all of respondents.

Results

First time assessment with scale of 1 (YES) or 2 (NO), for throwing action respondents mean \pm standard deviation's rating was 1.87 ± 0.34 for motivation, 1.76 ± 0.43 for knowledge, 1.98 ± 0.13 for confidence, 1.94 ± 0.25 for understanding and 1.87 ± 0.34 for overall physical competence. For physical competence Likert Scale of 1-5, with 5 most excellence, the first session's rating was 3.71 ± 0.55 .

For the second time assessment, respondents' average rating was 1.89 ± 0.32 for motivation, 1.74 ± 0.44 for knowledge, 2.00 ± 0.00 for confidence, 1.89 ± 0.32 for understanding and 1.76 ± 0.43 for overall physical competence. For physical competence Likert Scale of 1-5, with 5 most excellence, the second session's rating was 3.68 ± 0.59 .

For reliability, Cronbach's Alpha α was 0.767 for motivation, 0.524 for knowledge, 5.733E-14 (ICC single and average measures = 0.000) for confidence, 0.475 (ICC = 0.309 single measures, 0.472 average measures) for understanding, 0.712 (ICC = 0.525 single measures, 0.689 average measures) for overall physical competence.

For physical competence Likert Scale of 1-5, reliability Cronbach's Alpha α was 0.826 (ICC = 0.707

single measures, 0.828 average measures). The CFM-1 also has been found valid to be used for physical literacy assessment purposes.

Table 1

Domains	Session 1 Mean \pm SD	Session 2 Mean \pm SD	Cronbach's Alpha α	ICC	
Motivation	1.87 \pm 0.34	1.89 \pm 0.32	0.767	S	0.626
				A	0.770
Knowledge	1.76 \pm 0.43	1.74 \pm 0.44	0.524	S	0.362
				A	0.531
Confidence	1.98 \pm 0.13	2.00 \pm 0.00	5.733E-14	S	0.000
				A	0.000
Understanding	1.94 \pm 0.25	1.89 \pm 0.32	0.475	S	0.309
				A	0.472
Physical Competence	1.87 \pm 0.34	1.76 \pm 0.43	0.712	S	0.525
				A	0.689
Comprehensive Ratings for Physical Competence	3.71 \pm 0.55	3.68 \pm 0.59	0.826	S	0.707
				A	0.828

* S=ICC single measures; A=ICC average measures

Table 1. Average ratings given by respondents to the overhead ball throwing performance for one single video selected out of five videos for the purpose of this test. For this study α coefficient between 0.65 and 0.8 is considered as “Good”, with below 0.5 considered as “Unacceptable”. For ICC values: < 0.5 poor reliability, values between 0.5 and 0.75 moderate reliability, values between 0.75 and 0.9 good reliability, and values greater than 0.90 indicate excellent reliability.

Discussion and Conclusion

Out of all six test items listed in Table 1, the “Understanding” item’s reliability level based on Cronbach’s Alpha is the lowest and below acceptable level. This indicates that current method of use for CFM-1 need to be improved and rectify as it seems not able to determine the understanding domain of physical literacy. Understanding level was determined by asking questions such as “Do you know why we need to do this?” and/or “Do you know how to do this?”. However, as it was verbally asked with some on-site modifications by the tester in order to make it understandable to the involved very young kids, it may have been hard to be interpreted (either they understood or not, as not every kids will answer directly yes or no) by respondents that watch the video of the communication happening shortly prior the activity. Due to this, CFM-1 form may not be reliable enough to assess understanding level among 5-6 years old children.

As for the comprehensive physical competence which was based on 5-level Likert scale, the reliability level can be considered as excellent. For other items rated based on thumbs-up (yes = 2-points) or thumbs- down (No = 1-point) icon, the overall physical competence and motivation domains showed good level of reliability. The knowledge domain on the other hand, indicated that it has a very low level of reliability, nearly falls in the same reliability level as “understanding” domain. Again, it may in the end depends on the acceptance or perception of the respondent (tester), on what constitute as knowledgeable. Some may assume that able to perform or able to say yes or nodded their head will simply means they have the knowledge, but others may be looking for more comprehensive assessment of knowledge.

In conclusion, the CFM-1 instruments can be said as reliable to be used for physical literacy assessment, with no problems in term of reliability observed for all psychomotor and affective domain of learning, but some modification in term of the method of the test be conducted may need to be clarified and adjusted (especially for the cognitive part of the test - knowledge and understanding).

Practical Applications: The CFM-1 instruments when used to assess literacy level in any types of physical movement or exercise or activity, should always be accompanied by itemized criteria of what can be said as a excellence performance level for it.

This criteria can either be obtained from any resources related to that particular movement or activity, or can be developed by the assessor based on their own experience and knowledge. Most important to always ensure that the goal of the movement is clearly accepted and understood by the assessor and the participant. The used of quantitative marking system is not compulsory to be used, as if the records are kept based on actual CFM-1 form provided, future quantitative statistical analyses is always possible. Marking system for thumbs up and thumbs down in future will be changed into 1 and 0, instead of 2 and 1 marks. This makes it easier for tester to use as it goes well with qualitative description which said yes or no.

Acknowledgements: This study is part of studies funded by National Child Development Research Centre (NCDRC) (2017-0006-106-04), Sultan Idris Education University. The researcher's team would also like to thank all 2018 early childhood education teachers at NCDRC's pre-school for their assistance and support.

Ethical Clearance: This study was approved by the National Child Development and Research Center (NCDRC), Sultan Idris Education University.

Conflict of Interest: Nil.

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