Teaching Psychomotor Skills with E-Sports Courseware

R. S. Shariffudin, N. Mislan, C. K. Wong, and G. C. H. Julia, *Member, IACSIT*

Abstract— **Computer Aided Learning (CAL) is no more an uncommon phenomena in the education arena of Malaysia today. This instructional approach had been applied in the process of teaching and learning for many school subjects but there is very little application in Physical Education. The purpose of this study was to investigate the effects of E-Sports courseware for teaching psychomotor skills which was developed based on the Simpson's Psychomotor Domain Taxonomy. The E-Sports courseware was developed for the topic of Triple Jump in Physical Education syllabus. This descriptive type of study comprised of 60 samples from a secondary school in Malaysia. The instruments of the study were questionnaires to evaluate the courseware, a pre-test and post-test analyzed using t-Test for students' performance. The data were also supported by interviews and observations while interacting with the courseware. The significant value of 0.000 showed that there were differences before and after learning with the courseware. This means that there is an increase in knowledge of skills in triple jump. The result of the study also showed positive effects on level of achievement in Simpson's Psychomotor Domain Taxonomy. As a conclusion, the development of E-Sports courseware is able to trigger positive effects towards students' psychomotor skills learning and may assist in identifying young sport talent.**

Index Terms— **multimedia courseware, physical education, psychomotor skills, Simpson's Psychomotor Domain Taxonomy.**

I. Introduction

Computer technology and multimedia have long been applied in the teaching and learning processes with promising advantages. Utilizing the right combination of multimedia elements will influence the way students learn, increase their interest, enhance their performance and affect the learning environments [11]. In the Education Development Master Plan (PIPP) 2001-2010, the Ministry of Education in Malaysia has been making efforts to widen the usage of ICT in all national schools by assuring that all schools be equipped with infrastructures, tools, software and well-trained teachers with computer mastery skills. A variety of multimedia courseware was developed for use in teaching and learning but mostly on academic subjects such as languages or science and mathematics.

Physical Education is a compulsory course taken during primary and secondary education that encourages learning of psychomotor skills in a game or movement exploration setting [3]. It is an educational process that integrates the development of physical, intellectual, social and spiritual aspects for each student [9]. It aims to impart a life long impact on student as building psychomotor skills and participation will lead to positive behavior towards long term commitment for physical activities to build a healthy body. The Physical Education curriculum stresses on three main domains, which are cognitive, psychomotor and affective domains. Physical Education is an imperative tool for development, giving instructions and physical skills evaluation [13]. According to Simpson's Psychomotor Domain Taxonomy, the psychomotor domain includes physical movement, coordination, and use of the motor-skill areas. There are seven major skill categories, from the simplest behavior to the most complex, and development of these skills requires proper and repetitive practice which can be measured in terms of speed, precision, distance, procedures, or techniques in execution. Proper guidance and instruction from the Physical Education teachers are very much needed to avoid unnecessary accidents. However, it is difficult for a Physical Education teacher to ensure all students acquire the right movement patterns to fit every particular situation or specific problem.

Furthermore, part of the traditional teaching method is not sufficient as the students' interest in Physical Education become more and more deteriorated due to the lack of variety in teaching aids and creativity of the teachers [7]. Thus a multimedia courseware may be a solution as the students can learn independently and repeatedly in an interactive environment and in a meaningful way. Research by Jamali (2009) shows that multimedia courseware increased the interest of the students in handball and thus achieved better understanding of the game and skills [8]. Most of the presently used courseware for sports were developed based on general learning theory and did not consider psychomotor skills learning theories.

Prior to conducting this research, a preliminary survey involving 10 Physical Education teachers from different secondary schools in Malaysia was carried out to identify the difficult sports skills that the students commonly face. The survey indicates that the most difficult sports skill to learn is the Triple Jump as it requires high level skills. In the effort to assist the students in mastering the Triple Jump skill, this current study designed and developed a courseware, namely E-Sports based on Simpson Psychomotor Domain theory. The content of the courseware was designed in accordance to Simpson's Psychomotor Domain Taxonomy namely perception, set, guided response, mechanism, complex overt

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R. S. Shariffudin is a professor with the Department of Multimedia, Universiti Teknologi Malaysia, Malaysia (e-mail: rio-sumarni@utm.my).

N. Mislan is a lecturer with the Department of Multimedia, Universiti Teknologi Malaysia, Malaysia (e-mail: noramislan@yahoo.com.sg).

C. K. Wong is a senior assistant of Co-Curricular in SMK (P) Sultan Ibrahim, Johor Bahru, Johor. (e-mail: wckths@gmail.com).

G. C. H. Julia is a teacher in SMK Skudai, Johor and also a PhD student in Educational Technology, Universiti Teknologi Malaysia. (e-mail: alwaysjulia@hotmail.com).

response, adaptation and originality. The effectiveness and usability of the courseware were also evaluated to determine whether there is a significant difference on the students' achievement in Simpson Psychomotor Taxonomy Domains in learning the Triple Jump using E-Sports compared to traditional teaching method. Five aspects of the courseware were evaluated: fulfillment of teaching objectives, courseware user-friendliness, students' interest, aid for Physical Education teachers and courseware content.

II. Theoretical Framework

In this research, a Constructivist learning environment was applied to develop the E-Sports courseware. With well-planned courseware design, learners can easily generate, construct new idea or restructure their existing idea and apply the concepts in different situations effectively [11], [12]. Some characteristics of a constructivist classroom are that students learn how to learn and relate their learning to the real world outside the classroom [6]. Mulligan, Dodson and McCracken (2004) developed a learning system, "THINKHOCKEY" using Constructivism approach allowed the hockey players to withdraw one's self from the old scheme and building new meaning in the latest situation, forming new knowledge from the combination of previous and new experiences [4]. Constructivism focuses on tools and environments which help the students to interpret various perspectives of the world with their own experiences [5]. In this study, the students were to learn the Triple Jump knowledge and skills through the E-Sports courseware and be evaluated in theory and in real practice.

For the courseware content, seven categories from the Simpson's Psychomotor Domain Taxonomy were integrated into the courseware to improve the students' understanding and their psychomotor skills by levels. Simpson's taxonomy is adequate and appropriate for young children or adults learning entirely new and challenging physical skills as it addresses issues such as awareness, perception (and by implication attitudinal), emotion, sensory, and mental preparation. This taxonomy in a progressive manner focuses on skills from guided response to reflex or habitual response, and lastly towards originality aspect as the highest level. The seven categories were used as the courseware evaluation criteria in the post-test. The theoretical framework for courseware development is shown in below (See Appendix I).

III. E-Sports Courseware

E-Sports courseware is developed on the topic of Triple Jump based on the high school Physical Education syllabuses. The instructional design adapted from ADDIE model was used (see Appendix II). Multimedia elements such as text, graphic, video, audio and animation were integrated in developing the courseware so that students may experience a real situation of practicing the Triple Jump. Fig 1 displays some screen shots of the E-Sports Courseware. Fig. 2 shows the flowchart for the design of the courseware.

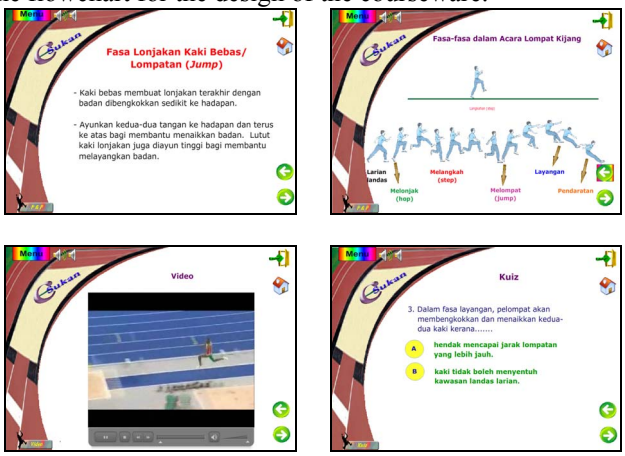


Fig. 1. Some screenshots of E-Sports.

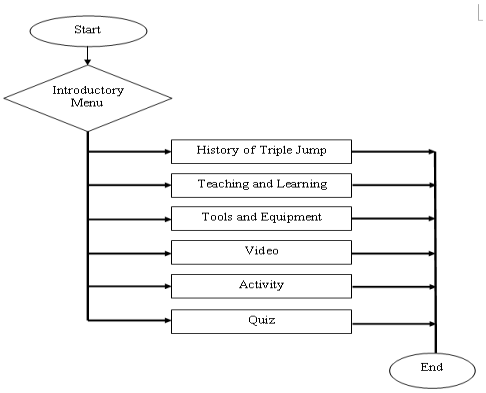


Fig. 2. Flow chart of E-Sports.

IV. Methodology

A quasi-experimental research design was used in this study as the researcher could not randomly assign participants to comparison groups due to their time table and syllabus constraints. 60 students were assigned into two groups. Lessons relating to Triple Jump were taught using E-Sports courseware by the Physical Education teachers. Students from this group were compared with those in control classes where the Physical Education teacher taught the lessons by notes, demonstration and drill and practice. The study was conducted for one month by using E-Sports. The instruments used for data collection included a pre-test (test question relating to Triple Jump), post-test, observations and interviews. Appendix III showed the questions used in pre-test and post-test to evaluate the students' understanding level of Triple Jump. After the post-test, the students demonstrated their Triple Jump skills and were evaluated using observation and interview based on the seven categories of the taxonomy (see Appendix IV).

V. Results

Students performed better in mastering Triple Jump skill in E-Sports group than in the control group with the mean score of 40.13 compared to 38.27. Table I and II show that there traditional group. The significant differences in the increment scores for both groups implied that learning in both groups were differences before and after learning process with the significant value of $p<0.000$ for both experimental and

had indeed taken place. No significant difference between the mean scores of control group and experimental group in pre-test and post test score as shown in Table III with the significant (2-tailed) value of p = 0.59 and 0.4 which are greater than $\alpha = 0.05$.

After the students completed their post-test, they were asked to perform the Triple Jump twice and the best distance was recorded. Table IV showed the observation results for control group and it was observed that the highest level the students could achieve was stage 6, Adaptation. However, many among them perform badly in stage 5, Complex Overt Response. Similar finding for experimental group where the student did not master stage 5 completely yet could do better in stage 6 (see Table V). In overall, observation result showed that 86.67% of the control group students and 73.33% of the experimental group students were able to master stage 6 (Adaptation skill) in Triple Jump skills.

After the pre-test, post-test and observation were conducted, three students from each group were randomly selected to be interviewed. Their respective PE teachers were invited to join the interview too.

Question 1: In your view, which method is better in attracting the students' attention in learning Triple Jump?

K7 : The traditional method. Because can get real experience.

K18 : The traditional method as learning is easier to take place.

K26 : I prefer learning the Triple Jump in the field as I can try and

practice it myself.

R3 : CD or E-Sports because it is more attractive.

R9 : I prefer practical, that is to do the Triple Jump.

R20 : CD because can see the athlete perform the skills correctly.

Teacher : Teaching with E-Sports courseware can attract the students better.

It is also more suitable for teacher who lacks the experience or don't know how to do it themselves. E-Sports is good to be used for new topics and is suitable as a replacement when the teacher is not around.

Question 2: In your view, which method is more effective, the E-Sports courseware or the traditional teaching?

K7 : I prefer the traditional teaching.

K18 : I think the traditional teaching for Triple Jump is more suitable.

K26 : I prefer the traditional teaching in learning PE but E-Sports fits for introduction.

R3 : I like both.

R9 : I think E-Sports can be for concept introduction, then only to do it.

R20 : I prefer to do it in real way.

Teacher : In my opinion, the traditional method is more effective but it would be best if both methods are combined.

Question 3: You achieve better marks in post-test compared to in pre-test, can you explain the reason of this happening?

K7 : I think it is because I done a lot of training.

K18 : I asked my teacher during PE lesson after the pre-test.

K26 : I referred to the text book after the pre-test.

R3 : I watched the CD repeatedly.

R9 : I got the answers from the CD.

R20 : I discussed with my friends while watching the CD.

Question 4: You achieve lower marks in post-test compared to in pre-test, can you explain the reason of this happening?

(All the research samples showed marks increment in post-test compared to pre-test.)

Question 5: Does the E-Sports courseware help you in mastering the skills in Triple Jump?

K7 : Yes, E-Sports really helps in learning Triple Jump.

K18 : I agree. At least it can introduce the concept of Triple Jump before we practice it.

K26 : Yes, I agree.

R3 : E-Sports are good for introducing the concept.

R9 : Yes, I agree. But still need teacher at the side to give the proper instruction.

R20 : Yes, E-Sports helps but we still need teachers for the demonstration.

Teacher : Indeed it can help students particularly in concept and explaining the movements.

Question 6: Do you like the video in the E-Sports courseware and why?

R3 : Yes, but the explanation is quite long.

R9 : I like it. It would be better to have more navigation.

R20 : Yes, can see the real action.

Teacher : Video can increase the knowledge and replace the text book in explaining the movement.

CONCLUSION

The findings of the study supported the effectiveness of the E-Sports courseware. The courseware, which adopts the constructivism approach, has been proven to be useful and effective through the significant improvement shown by the experimental group students. From the interview, the researchers found out that E-Sports courseware indeed gave a positive impact to the learning of psychomotor skills. The students felt good, attracted and believed in the usage of the courseware. Researchers also observed that the students interacted actively with the computer and showed interest in their learning session. The benefits of E-Sports include: it helps the students to overcome the difficulties and challenges faced by students when mastering the Triple Jump skills, students may learn the courseware anytime and anywhere at their own pace, and it also helps to reduce the teachers' burden by reducing the time taken in the teaching and learning sessions. The students in the experimental group also gave a fairly high evaluation and satisfaction of the courseware. The study is in line with other studies that had used multimedia courseware for the purpose of teaching and

learning Physical Education [1], [2], [5], [10]. Multimedia courseware increases students' performance via active learning. It encourages students to play an active role with more autonomy in the learning process [2].

TABLE I: T-TEST RESULT FOR EXPERIMENTAL GROUP

Experimental Group	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre test – Post test	-1.80	10.25	1.87	-21.83	-14.17	-9.620	29	.000

TABLE II: T-TEST RESULT FOR CONTROL GROUP

Control Group	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre test – Post test	-1.94	7.00	1.28	-22.05	-16.82	-15.20	29	.000

TABLE III: T-TEST RESULT BETWEEN CONTROL GROUP AND EXPERIMENTAL GROUP IN PRE-TEST AND PORT-TEST

Control group – Experimental group	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre - test	-3.30	9.18	1.68	-6.73	0.13	-1.97	29	.590
Post - test	-1.87	11.97	2.18	-6.34	2.60	-0.85	29	.400

TABLE IV: OBSERVATION RESULTS OF CONTROL GROUP IN TRIPLE JUMP

Student (Control Group)	Post-test Marks	P2	P3	P4	P5	P6	P7	Jump distance
K3	35	/	/	/	X	/	X	4.70m
K4	43	/	/	/	X	/	X	Cancel
K7	**54**	/	/	/	**X**	/	**X**	**6.78m**
K9	46	/	/	/	X	X	X	5.17m
K17	44	/	/	/	X	/	X	5.30m
K18	49	/	/	/	X	/	X	Batal
K19	36	/	/	/	X	/	X	Batal
K20	**31**	/	/	/	**X**	/	**X**	**Cancel**
K21	39	/	/	/	X	/	X	5.29m
K22	44	/	/	/	X	/	X	4.69m
K24	41	/	/	/	X	/	X	4.71m
K25	42	/	/	/	X	/	X	4.43m
K26	34	/	/	/	X	/	X	4.78m
K28	41	/	/	/	X	/	X	Cancel
K30	39	/	/	/	X	X	X	5.22m
Total		**15**	**15**	**15**	**0**	**13**	**0**	

** P – Simpson's Psychomotor Taxonomy Domain Stages

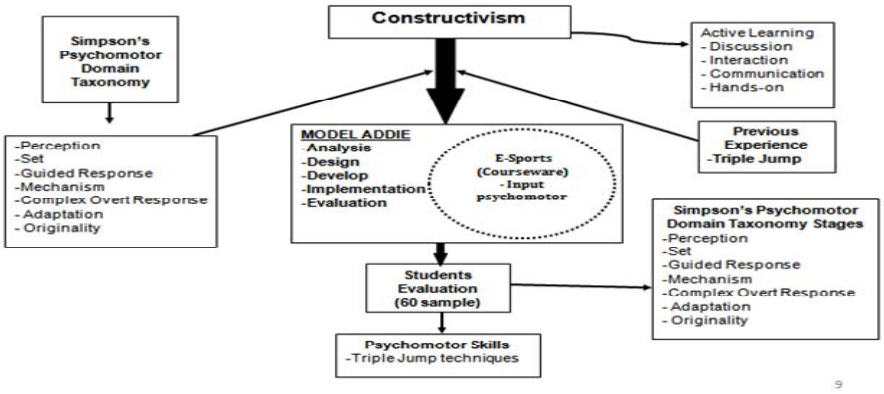
TABLE V: OBSERVATION RESULTS OF EXPERIMENTAL GROUP IN TRIPLE JUMP

Student (Experimental Group)	Post-test Marks	P2	P3	P4	P5	P6	P7	Jump Distance
R1	42	/	/	/	X	/	X	5.35m
R2	**65**	/	/	/	**X**	/	**X**	**4.92m**
R3	36	/	/	/	X	X	X	Cancel
R5	44	/	/	/	X	/	X	5.88m
R7	39	/	/	/	X	X	X	5.05m
R9	35	/	/	/	X	/	X	5.35m
R13	46	/	/	/	X	/	X	5.88m
R15	45	/	/	/	X	X	X	4.60m
R16	37	/	/	/	X	/	X	5.55m
R18	38	/	/	/	X	/	X	6.22m
R24	37	/	/	/	X	/	X	5.18m
R26	50	/	/	/	X	/	X	5.42m
R27	34	/	/	/	X	/	X	4.37m
R29	**31**	/	/	/	**X**	**X**	**X**	**5.29m**
R30	38	/	/	/	X	X	X	Cancel
Total		**15**	**15**	**15**	0	10	0	

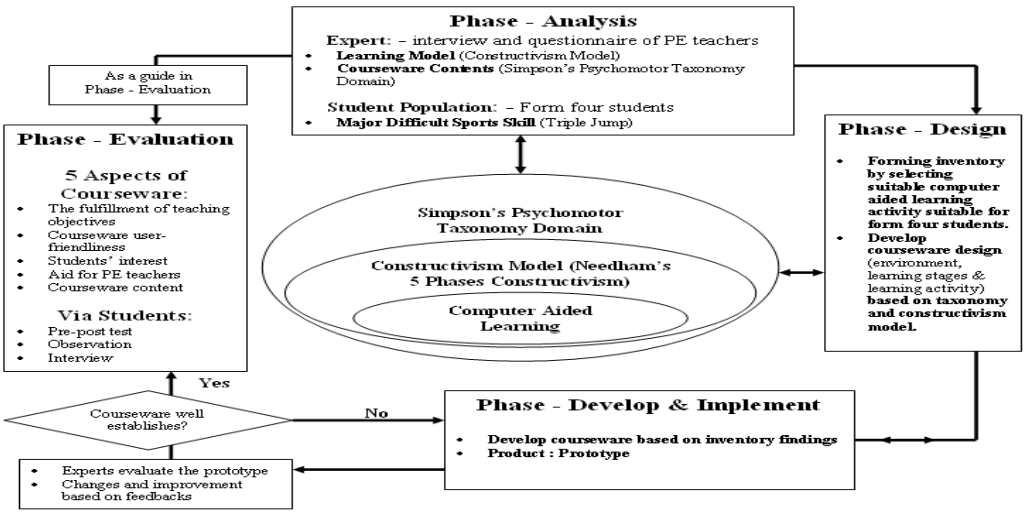
** P – Simpson's Psychomotor Taxonomy Domain Stages

APPENDIX

APPENDIX I: THEORETICAL FRAMEWORK



APPENDIX II: INSTRUCTIONAL DESIGN ADAPTED FROM MODEL ADDIE



APPENDIX III: QUESTIONS IN PRE-TEST, POST-TEST AND OBSERVATION

Stages of Simpson's Psychomotor Domains Taxonomy	Pre-test and Post-test		Observation	
	No. of questions	Example of test question	Skills	Aspect of observation
Perception	1, 4, and 17	Q1: List two differences between Triple Jump and Long Jump.	Awareness	Tested in Pre-test and Post-test
Set	2	Q2: State the benefits of warm up activities for Triple Jump.	Readiness	1. Is the student ready?
Guided Response	3, 8, 5 and 9	Q3: List out the rules for Triple Jump.	Trying	1. Carry out the warm up activities in E-Sports courseware. 2. Measuring the running steps in phase approach. 3. Checking the landing area.
Mechanism	6, 10 and 18	Q10: In the step phase, the competitor should … A. incline the body to the front, knee held high B. straighten the body, knee held high C. incline the body to the back, knee held low D. straighten the body, knee held low	Basic Skills	1. Demonstrate the Triple Jump phases correctly.
Complex Overt Response	12	Q12: Match the phases in Triple Jump with the given situation movements.	High level skills	1. Carry out Triple Jump with well controlled body coordination for each phases? 2. Improve movement after jumping?
Adaptation	13, 14, 15 and 16	Q14: A Triple Jump competitor must have a controlled _____ so that he will not fall easily when practicing the activity.	Adaptation skills	1. Improve and adjust running steps for jumping? 2. Body coordination stable and smooth?
Originality	7 and 11	Q11: What are the improvement steps for a competitor to increase his Triple Jump distance?	Creativity skills	1. Improve on jumping technique? 2. Able to do the jump with well controlled body confidently?

Appendix IV: EVALUATION OF SIMPSON'S PSYCHOMOTOR TAXONOMY DOMAIN BY OBSERVATION

Level	Level Explanation	Type of Assessment	Observation
Perception	The ability to use sensory cues to guide motor activity. This ranges from sensory stimulation, through cue selection, to translation.	Test questions	1. Tested by pre and post test.
Set	Readiness to act. It includes mental, physical, and emotional sets. These three sets are dispositions that predetermine a person's response to different situations (sometimes called mindsets).	Questionnaires	. Is the respondent ready?
Guided response	The early stages in learning a complex skill that includes imitation and trial and error. Adequacy of performance is achieved by practicing.	Observation (check list)	1. Doing warm-up exercises according to the E-Sports courseware. 2. Measure the running steps for running phase. 3. Examine the landing area of triple jump.
Mechanism	This is the intermediate stage in learning a complex skill. Learned responses have become habitual and the movements can be performed with some confidence and proficiency.	Observation (check list)	1. Performing the correct phases of triple jump. 2. Execute the triple jump trial.
Complex or overt response	The skilful performance of motor acts that involve complex movement patterns. Proficiency is indicated by a quick, accurate, and highly coordinated performance, requiring a minimum of energy. This category includes performing without hesitation, and automatic performance. For example, players often utter sounds of satisfaction or expletives as soon as they hit a tennis ball or throw a football, because they can tell by the feel of the act what the result will produce.	Observation/ Execution (check list)	1. Performing triple jump with good and controlled body coordination? **A. The Approach/Running Phase** -running fast and controlled (straight upright and high knee) -number of steps: 13-15 **The Hop Phase** -steps on the take off board with one leg -bend the hopping leg after taking off from the take off board -free leg swing to back and slightly bend -move the hopping leg to the front to reach the running path, free leg pull back -head and body upright, look to the front, hands help to balance the body **C. The Step Phase** -swing the hands to help to lift the body straight up -swing the free leg high to the front with high knee **D. The Jump Phase** -bend the body after jumping and swing both hands high up to the front -lift up the knee of the jumping leg **E. The Flight Phase** -swing the knees and both hands high up to the front after jumping -straighten both legs before landing -body bends to the front **F. The Landing Phase** -stretch both legs to the front and balance by bringing the hands to the back -bends the body to the front -landing with both feet and stretch the body to the front 2. Improve movement after jumping?
Adaptation	Skills are well developed and the individual can modify movement patterns to fit special requirements.	Observation/ Execution (check list)	1. Improve running steps to jump? 2. Body coordination getting better: -under control/stable -smooth
Origination	Creating new movement patterns to fit a particular situation or specific problem. Learning outcomes emphasize creativity based upon highly developed skills.	Observation/ Execution (check list)	1. To make improvement towards jumping style? 2. Can execute jumping with controlled body and confident? 3. Making effort to change the style of legs during the flight phase? - the stride jump - the hang style - the hitch kick style

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Prof Dr. Rio Sumarni Shariffudin has twenty years experience in training teachers and professionals in areas of teacher education, staff development, leadership, instructional design and software development. She has received many awards of excellence, gold and silver medals for her works at the national and international levels. She has also authored many books in her area of expertise.

Nora Mislan is currently working as a lecturer in Universiti Teknologi Malaysia, Johor Bahru in the Department of Foundation Education. She was born in Singapore and has more than eleven years experience teaching in primary schools and later running her own early childhood education centre. She used to write programme modules and was a subject matter expert with a private university in Malaysia and was a lecturer at a private university in Singapore.

Wong Cheui Keen obtained her 1st Degree of Physical Education from University Putra Malaysia (1994) and her Master Degree of Educational Technology from University Technology Malaysia (2011). She has eighteen years experience in teaching Physical Education and holding the post as Sports Secretary for fifteen years. She has experiences in giving talk on Athletic Officiating and an active Grade 1 member in MAAU (Malaysian Amateur Athletic Union).

Currently, she worked as Senior Assistant of Co-Curricular in SMK (P) Sultan Ibrahim, Johor Bahru, Johor.

Julia Guan Chin Hsien is currently working as a secondary school teacher in SMK Skudai, Johor. She has 6 years experience in teaching Mathematics and computer. She received her Master Degree of Educational Technology (Multimedia) (2003) in Universiti Teknologi Malaysia (UTM) and currently pursuing her PhD in Educational Technology (Multimedia) in UTM.

She received medal in developing educational courseware. Her research interests include learning styles and mobile learning.