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Movement Literation Educational Game Based on Dance Notation to Diagnostic Kinesthetic Intelligence of Junior High School Students

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ABSTRACT

The purpose of this study is to be able to diagnose kinesthetic intelligence possessed by students with the help of educational games so that they have perceptual abilities through observing motion symbols that have an impact on body language. Besides that, it can optimize its creativity as humanistic literacy, by utilizing data available on the web as data literacy. The use of educational games is expected to make students feel happy and comfortable in participating in learning (joyful learning). Learning by using educational games will make students feel that the activity they are doing is playing games, but actually they are learning something that has been planned by the teacher. This research method uses Research and Development or R&D procedures. However, in this study only at the design stage of the motion literacy educational game prototype. Sampling used purposive with a total of 10 school teachers who have cultural arts teachers with a background in dance. Data analysis techniques to ensure that instruments in the form of motion literacy educational games become reliable devices through qualitative analysis with experts. This research produced a motion literacy educational game prototype consisting of instructions on how to play, manual, and start playing. This game can diagnose kinesthetic intelligence, critical and creative thinking skills in learning arts and culture in schools, especially dance, so that it can predict students' skills in dance.

Keywords: *Educational Games, Motion Literacy, Kinesthetic Intelligence*

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INTRODUCTION

Game education is a development of gamification which explicitly embeds game elements into learning. Game education will build the right connection between knowledge, and the game content space. In the motion literacy education game that will be developed based on dance notation. This game will connect one's reasoning with kinesthetic, because in dance notation there are symbols that must be understood, then performed with movements that match those symbols. Dance notation was developed by Rudolf Van Laban

(1959), at that time the recording media was not as popular as it is today, so it could only be done by recording motion symbols.

However, Laban's notation can inspire reasoning through reading, writing, and expressing motion symbols, which might be equivalent to motion literacy. Previous research has been conducted under the titles Labanotation-Based Motion Literacy Teaching Material Model for Diagnosing Kinesthetic Intelligence in Middle School Students (2019-2020) and Motion Literacy E-Assessment Model to Improve WEB-Based Kinesthetic Intelligence in Cultural Arts Learning in Middle School (2019-2020). (2019).

Based on the results of this study there is a problem, where junior high school students are still not motivated to be able to explore their kinesthetic abilities, so efforts need to be made through game education so that students feel happy as well as teachers can diagnose students' kinesthetic intelligence. The hope is that through games, students will be comfortable participating in learning, so that learning will be created in a more enjoyable atmosphere. Learning by using game education will make students feel that the activity they are doing is playing games, but actually they are learning something that has been planned by the teacher.

This year's research will produce a prototype of a motion literacy educational game called G.E.D.K (Game Education Diagnostic Kinesthetic) which can be used by teachers and students in assessing movement skills in arts and culture subjects, especially dance. The difficulty of teachers in carrying out dance learning is generally limited to psychomotor abilities or movement skills, because dance learning requires good kinesthetic intelligence in order to imitate motion, develop motion, perceive motion, manipulate motion, and improvise motion which is called movement literacy (Movement). literacy). This is in line with Harrow's theory which states that the psychomotor domain consists of manipulative, motor skills and movements that require neuromuscular coordination (Cooper & Harrow, 1973). In motion there is neuromuscular control to control movement so that it can be performed skillfully (Chin et al., 2016).

Laban notation is a dance notation that uses motion symbols to express movement in terms of spatial models and notions that clearly and properly define temporal patterns, actions, floor layouts, body parts, and the utilisation of three-dimensional space (Tongpaeng et al., 2017). Labanotation, which is dance notation, is knowledge for describing and storing dances that utilize the expressiveness of descriptive logic (Raheb et al., 2016)

To diagnose kinesthetic intelligence, instruments have been developed that use dance notation (Triana & Juniasih, 2019),), and assessments have been made that can be used by junior high school students (Devi Triana et al., 2020). However, in order to be able to diagnose easily, it is necessary to make educational games as an alternative in learning arts and culture activities, so that students feel happy doing it.

Motion-based games have been developed using pixel motion sensors (Mentis et al., 2014), which are then redeveloped in the form of traditional games using buttons and joysticks (Isbister & Mueller, 2015). Both forms of games need to be developed, by reading dance notations so that neuromuscular control over movement skills can measure kinesthetic intelligence in dance movements.

As an alternative game development methodology, this educational game can generate content automatically through an algorithm using a random process that generates an unexpected range of gameplay possibilities. Many educational games have been developed (Burzynska et al., 2017; Grammatikopoulou et al., 2019; Nyberg & Meckbach, 2017; Septiani, Khusnul Rahmah Eka Irsyadi, 2020) but educational games that can diagnose kinesthetic intelligence have not been developed, especially those related to learning the art of dance in the subject of cultural arts in junior high school. The advantage of motion literacy education games based on dance notation that diagnose kinesthetic intelligence in everyday life is that it can optimize data literacy, digital literacy, and humanistic literacy according to the needs of the 21st century.

METHODS

This research uses the Research and Development procedure with the following steps:

1. Research and Information Collecting (Prelimanary Studies)
    a. Needs analysis as follows:
        1) Mapping students' kinesthetic intelligence for arts and culture subjects, through movement literacy, especially dance
        2) Mapping kinesthetic intelligence and digital literacy of teachers and students in using digital applications
    b. Preliminary study to collect research findings and other information related to the product of educational games based on dance notation and kinesthetic intelligence.
2. Preliminary study to collect research findings and other information related to motion literacy educational game products based on dance notation and kinesthetic intelligence.
3. Designing an overview of the contents of the game can be seen through the flowchart and storyboard of the motion literacy educational game from the motion literacy educational game
4. Create a scheme for using motion literacy educational games
5. Evaluate the educational game model by material experts and media experts which are then analyzed and revised

For the purpose of creating a homogenous sample, a purposive sample was chosen, with schools that had motion literacy and equal technical literacy among the population in this study, which included instructors of arts and culture in Jakarta and junior high school students.

Data collection was carried out by analyzing the design of motion literacy educational games that would be used through FGD with material experts, game applications, and psychometrics to agree on a scoring system in diagnosing kinesthetic intelligence. The FGD will agree on 1) analysis of the needs of motion literacy educational games that will be used by junior high school students, 2) design of the models offered by

motion literacy educational games, 3) steps in their use to produce a scoring system that can diagnose kinesthetic intelligence for motion literacy.

Data analysis was carried out using various methods, both qualitatively and quantitatively. Qualitative analysis to determine the usefulness of game education in diagnosing kinesthetic intelligence, game use, effectiveness of use, ease and accuracy in measuring kinesthetic intelligence.

Data analysis uses descriptive qualitative and quantitative, especially in analyzing the need for literacy educational games that are in accordance with the characteristics of junior high school students. Quantitative data analysis will agree on the design or model of the motion literacy educational game that will be made.

RESULT AND DISCUSSION

Educational Game Analysis Stage

The world of games is now progressing along with the times. Usually when playing a game you need a joystick or keyboard, so now without any tools to hold, you can play several games. The technology used is called Kinect. This technology provides a unique experience for its users.

Kinect is an input device for motion detection produced by Microsoft for XBOX 360 Video Games and PC with the Windows operating system. By using a camera similar to a webcam, it allows Kinect to capture user movements so that users don't need to directly touch the game controller, enough to do natural movements.

Kinect for Xbox 360 or commonly known as Kinect (formerly known as Project Natal) is a “Controller-Free Gaming and Gaming Experience” created by Microsoft and defined as a controller for the Xbox 360 video game platform. Kinect continues to compete with the Wii Remote with the Wii MotionPlus. and PlayStation Move. By using the PlayStation Eye as a motion control system for the Playstation 3, making the Playstation 3 more comfortable to play.

Microsoft is showcasing the usage of Kinect to enhance education through Sesame Street broadcasts in the sphere of education. Children may engage with the Sesame Street characters on the TV screen by using the Kinect application instead of simply watching Sesame Street films.

Skeletal Tracking allows Kinect to recognize the user and follow their movements using an infrared (IR) camera. Kinect can recognize up to six users within range. Of these, two users can be recognized in detail. Utilization of Skeletal Tracking in an application can provide the position of the joints (skeleton joints) of the user that are recognized and follow their movements from time to time. Skeletal Tracking is optimized to recognize users who are standing or sitting, and facing the Kinect.

The Kinect SDK provides an API (Application Programming Interface) that makes accessing all nodes simple. Twenty accessible joint sites with corresponding joint names It has an RGB camera, a depth sensor, and a software-enabled multi-array microphone, making it capable of offering full-body 3D recognition as well as speech recognition capabilities. The depth sensor is comprised of an infrared laser projector and CMOS sensor

that records 3D video data in ambient light situations. The depth sensor's detection distance is configurable, and the Kinect software may automatically calibrate the sensor depending on gameplay and the player's physical surroundings, accounting for the presence of furniture and other obstructions.

Some of the core features of Microsoft Kinect for Windows include:

1) Kinect Fusion introduces the ability to create live, real-time 3D models, including full human models as well as physical objects.
2) The Kinect sensors can be moved around an object to scan and build the 3D model. Scan results can be exported and used in other applications.
3) Kinect Interactions will expand the motion gesture feature so that it can be developed further by developers. Microsoft itself admits that many developers use kinect as a function for the user interface.

Some of the games that have utilized Kinect technology in its use are Motion Sport, Dance Central, Kinect Sport, Your Shape Fitness Evolved, Kinect Adventure and many more. In addition, Kinect is usually used by Xbox users as sports media. The existence of games such as Kinect Sport, Your Shape Fitness makes users not have to go out of the house to exercise, and of course this is a separate added point for Kinect. Besides being made and used for playing, Kinect technology is also used in the world of Medical Rehab.

Desain Stage

At this stage it starts with designing the motion to be measured to diagnose kinesthetic intelligence based on Laban Notation.

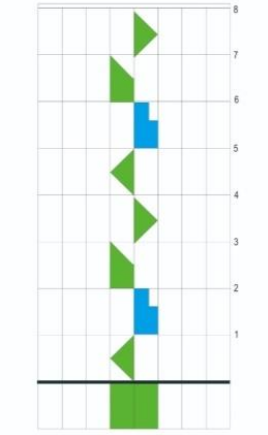


Figure 1. Footwork

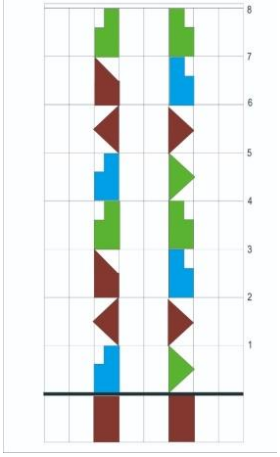


Figure 2. Hand gesture

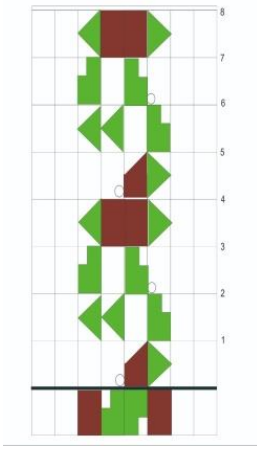
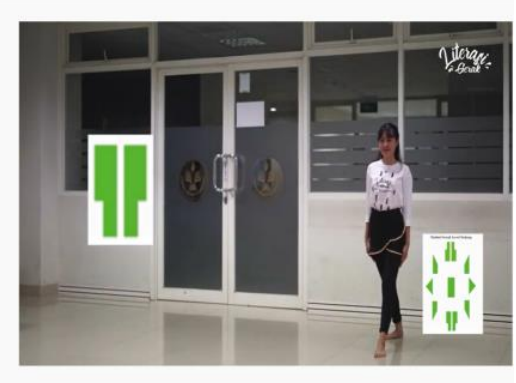


Figure 3. Movement of hands and feet

Table 1. Educational Game Prototype

No	Description	Picture
1	Overview of initial	

No	Description	Picture
	menu design	
12	Tutorial before playing game	
23	Start playing	
24	About Game	Game education is a fun medium to be able to diagnose kinesthetic intelligence possessed by students. This game can also be used in learning the art of dance at school.
25	About Us	Motion literacy educational game developer: 1. Dr. Dinny Devi Triana, M.Pd 2. Bambang Prasetya Adhi, S.Pd, M.Kom

No	Description	Picture
		Socialization and assistance team in utilizing game education: 1. Dr. Dinny Devi Triana, M.Pd 2. Putri Faridatun Nisa (Mahasiswa) Technical Team: 1. Dr. Rivo Panji Yudha Cooperation Partner: 1. Head taecher of art and culture: Ainul Wardah, M,Pd 2. Art and culture teacher in yunior high school Guru: Sinta Frieda Kus Erwin, S.Pd Email: Konseptor: dinnydevi@unj.ac.id Developer: bambangpadhi@unj.ac.id
26	Tutorial	Footwork  Hand gesture

No	Description	Picture
		 Movement of hands and feet
		
27	Game tools	1. TV/LCD 2. Kinect 3. Laptop/PC 4. Aplikasi 5. CD game/falsh disk/hard disk Installation process: 1. Download the kinect app 2. Download game education application 3. Install gaming apps 4. Connect the kinect device to the laptop/PC

Trial Stage

Through reading educational game symbols, a small-scale trial was done on seventh-grade students from SMP 13 South Jakarta, a partner school with varying

psychomotor ability levels. To determine if teachers can readily and effectively use educational games for diagnosing kinesthetic children..

A small-scale trial of 10 junior high school students obtained the following data:

1. Assessment of students' experience in using educational games: students answered that 20% said they were very happy, 50% said they were happy, and 30% said they were quite happy.
2. The design of the development of educational games: students answered that 30% said they were very happy, 30% said they were happy, 30% said they were quite happy, and 10% said they were not happy.
3. The level of satisfaction with the educational games offered: students answered that 40% were very satisfied, and 60% said they were satisfied.
4. Assessment of the game needed to use it: students answered 80% easy, and 20% difficult.
5. Assessment of game quality: students answered 20% very satisfied, 60% satisfied, 10% dissatisfied, and 10% neutral or did not answer.
6. Assessment of overall game performance: students answered very happy 40%, 30% happy, 30% quite happy.

Evaluation Stage

The variable map (Fig. 4) shows the units of measurement (column 1) between −1 and +1 logits (log-odd-units). The rater severity rating (column 2), the item difficulty level (column 3), and the rating scale function (column 4) are placed on the same interval scale, creating a single frame of reference, of interest in this result is column 2, showing the variation in rater severity.

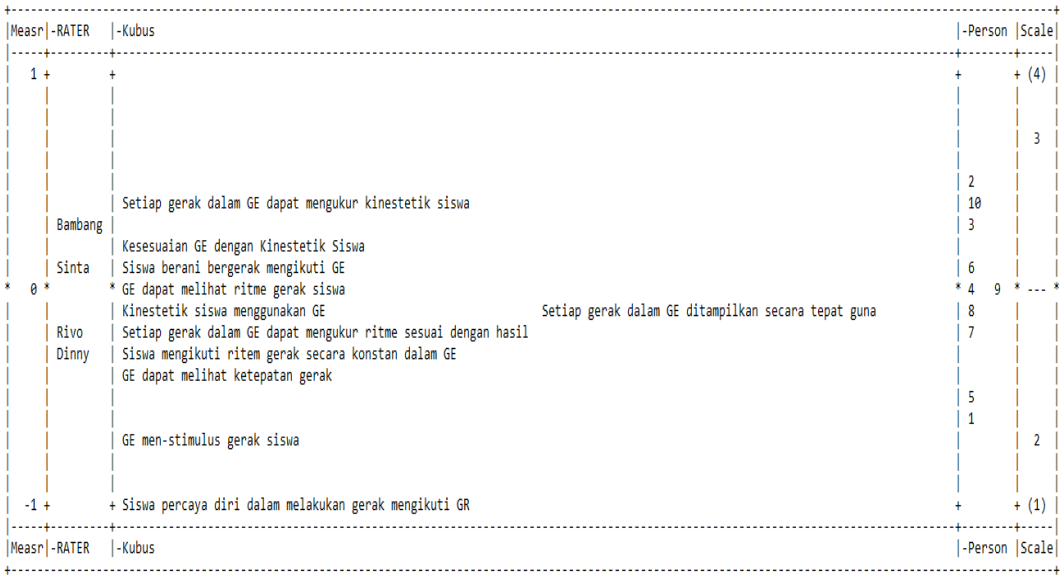


Figure 4. Wright Map

Figure 4 may provide some useful information from this analysis. Dives are labeled by the weight of their difficulty, such as every movement in educational games can measure students' kinesthetics, the suitability of educational games with students' kinesthetics and students who dare to move following educational games. This can be seen from the aspects assessed by looking at the rhythm of the students' movements, the kinesthetics of students using educational games. Students follow the constant rhythm of movement from educational games, educational games can see the accuracy of movement and every movement in educational games is shown effectively. The easiest aspect, labeled as a side in educational games, stimulates students' movements and students are confident in making movements, following the movements displayed in educational games.

Negative ratings imply poor test taker ability, assessor leniency, and item facilitation, whilst positive values suggest high test taker ability, severity, and difficulty. The column at the far right represents the respective raw score scale.

This wright map overview provides a broad overview of the test characteristics. The ability of the testees proved to be normally distributed, with most of the testees falling within the logit range of -1 to 1, while none of the students tested were anywhere near very low ability (<2 log). In contrast, the few students who demonstrated very high ability were anywhere near +1 log. Approximately half of test takers have sufficient traits to complete all items on the test. The test items are also fairly balanced between hard and easy items and are in the 0.50 to +0.50 log range. Finally, the four groups of raters were approximately equal and located at an average level of difficulty, indicating that educational game measures for measuring students' kinesthetic intelligence functioned well in terms of providing uniform guidance for raters.

In the following step, estimations of the logit score and the model fit index were examined for each investigated facet in order to validate the fit between the specific model parameters. The estimates of each person were evaluated first, followed by those of each rater, each rater group, each item, and then the estimates of each rater group's interaction with each item (Noem & Maximo, 2014).

Figure 5 depicts a section of the output on persons that was provided by the FACETS software (full output for 10 examinees). The personification measure revealed that, with the exception of the outliers displayed in the variable map, the Fit and Outfit indices of all of the students fell within the acceptable range of 0.50–1.50 (Wright & Linacre, 1994). This indicates that MFRM is capable of accurately estimating the capability of almost any individual. This exam may be effective when applied to additional test takers from the same demographic, based on a reliability score of 0.74 and a separation index of 1.70. (Wright, 1996).

Total Score	Total Count	Obsvd Average	Fair(M) Average	Measure	Model S.E.	Infit MnSq	Infit ZStd	Outfit MnSq	Outfit ZStd	Estim. Discrm	Correlation PtMea	PtExp	Nu	Person
133	44	3.02	3.04	-.60	.19	.86	-.7	.84	-.8	1.17	.28	.32	1	1
100	44	2.27	2.27	.51	.18	1.27	1.4	1.25	1.3	.67	.55	.35	2	2
106	44	2.41	2.41	.31	.18	1.04	.2	1.03	.1	.97	.46	.35	3	3
116	44	2.64	2.64	-.02	.18	.81	-1.0	.80	-1.1	1.34	.53	.34	4	4
129	44	2.93	2.94	-.46	.19	.90	-.4	.89	-.5	1.11	.26	.33	5	5
113	44	2.57	2.57	.08	.18	.70	-1.7	.70	-1.7	1.48	.39	.35	6	6
122	44	2.77	2.78	-.22	.18	1.05	.3	1.05	.3	.96	.39	.34	7	7
118	44	2.68	2.69	-.08	.18	1.12	.6	1.16	.9	.71	-.01	.34	8	8
115	44	2.61	2.62	.02	.18	.79	-1.1	.80	-1.1	1.32	.32	.34	9	9
102	44	2.32	2.31	.45	.18	1.37	1.9	1.38	1.9	.38	.18	.35	10	10
115.4	44.0	2.62	2.63	.00	.18	.99	-.1	.99	-.1		.33		Mean (Count: 10)	
10.3	.0	.23	.24	.35	.00	.21	1.1	.21	1.1		.16		S.D. (Population)	
10.8	.0	.25	.25	.36	.00	.22	1.2	.22	1.2		.17		S.D. (Sample)	

Model, Populn: RMSE .18 Adj (True) S.D. .29 Separation 1.58 Strata 2.44 Reliability .71
Model, Sample: RMSE .18 Adj (True) S.D. .31 Separation 1.70 Strata 2.60 Reliability .74
Model, Fixed (all same) chi-square: 34.0 d.f.: 9 significance (probability): .00

Figure 5. Judges Measurement Report (Rater Facet)

In particular, the test is able to evaluate a broad range of trait ability levels shown by the examinee. (X2 = 34, df = 9, p<0.000) The fixed effect X2 shows that the persons that were tested are statistically distinct from one another, which also means that independence in the person parameter is maintained. In addition, a comparison between the Fair-M estimate (M = 2.63, SD = 0.24) and the observed mean (M = 2.62, SD = 0.23) provides additional evidence that the scoring equation developed by the specialists is accurate. In other words, the average raw score has to have an adjustment made to it in order to compensate for the impacts of rater variability.

In addition, the separation index of this rater is 1.70, and its reliability is 0.74, which demonstrates that this rater has adequate inter-rater reliability. According to the FACETS software, reliability is calculated as a measure of within-sample variance; hence, low values within a sample of raters indicate that raters are largely uniform in evaluation. These are desirable attributes in terms of raters and markers of convergent validity (Wright, 1996). Even though a separation index of 1.70 may be thought to be low, the fact that it is larger than 1.00 suggests that all three raters are somewhat similar to being heterogeneous raters.

CONCLUSSION

The educational game that has been designed is a prototype that junior high school students can use to diagnose kinesthetic intelligence. Design development is carried out through the analysis stage of dance art material in grade 7, game education planning which is carried out through discussions, making tutorials, and motion material which is the stimulus in this game.

Speed and accuracy are one of the basics in measuring kinesthetic intelligence by looking at the modified Laban Notation dance symbols. Giving color is one way to make symbols easy to remember, especially when doing low, medium, and high level moves. Giving a brown color to the low level is analogous to the color of the ground. The green color for the medium level is analogous to trees, and the high level blue color is analogous to the sky. It is hoped that the ease of capturing symbols quickly and precisely through educational game stimuli with Kinect media can be used to diagnose the kinesthetic intelligence of junior high school students.

Based on the results of the development of an educational game designed to diagnose kinesthetic intelligence in junior high school students, it can be seen:

1) The development of an educational game model was designed based on an analysis of the needs of junior high school students who have limitations in psychomotor skills, even by imitating the movements contained in educational game shows. This can be seen from the results of the trial where 25% of students had difficulty
2) In educational game material by reading and practicing dance notation symbols called Motion Literacy, some students still find it difficult, even though imitating the motion contained in educational games is fun.

Thus the steps in the motion literacy educational game can be used to diagnose dance kinesthetic intelligence, in a fun way, and can serve to measure students' kinesthetic intelligence well in terms of providing uniform guidance for assessors. 50% of students have sufficient ability to complete all the moves in the educational game.

Every movement in educational games can measure students' kinesthetics, by looking at the suitability of the movements shown in educational games with students' kinesthetics and students who dare to move in following educational games. This can also be seen in the rhythmic aspects of movement that form kinesthetics by using educational games. Students can follow the constant rhythm of motion from motion displays in educational games. Educational games can see the accuracy of the movements made by students in every movement in educational games, so that educational games can be displayed effectively. The easiest aspect, from an educational point of view, is to stimulate student movement and students are confident in making movements, following the movements shown in educational games.

RECOMMENDATION

Two components are fundamentally necessary for games: strong guidance and an engaging environment. In the event that this does not occur, the process of learning will not be finished. This guideline makes it possible to monitor any odd conduct exhibited by the user and assists in the prevention of improper behaviour, which may be but is not socially acceptable behaviour even if it is (Noemí & Máximo, 2014). It also helps promote the added value that serious play brings to the educational process (onsite or online learning processes).

Literacy is a broad phrase that refers to a collection of abilities and individual skills in reading, writing, speaking, calculating, and problem-solving at a particular degree of competence required in day-to-day living. These abilities and skills are necessary for people to function effectively in society. Literacy in motion, often called motive writing, is a method that helps people have a better understanding of the material covered in dance classes. One may interpret this as an expression of the statement that was spoken on the stage above. Students are able to demonstrate where (level, direction), when, and why through the use of writing reasons (duration, meter, pulse, tempo).

Based on this study, it is necessary for high school students to have movement literacy skills that can diagnose kinesthetic intelligence in dance learning to recognize space, time, and energy.

LIMITATION

Students can pay attention to the kinesthetic symbols of dance, such as body posture, weight distribution, and the sense of tension or liberation in the muscles, and then describe their experiences with the expressed movements. Students learn dance while polishing their language abilities and begin to engage in interdisciplinary, cross-experience activities that foster comprehension and inspire creativity (TED, 2007). The symbols in this dance are known as Laban Notation which is a tool to make it easier for dancers to read movements, so that movements can be well documented.

DATA AVAILABILITY

The data supporting the conclusions of this investigation are accessible upon reasonable request from the corresponding author.

CONFLICTS OF INTEREST

The authors state that they do not have any competing interests to declare.

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