Acta Kinesiologica
Ahead of print
DOI. 10.51371/issn.1840-2976.709

Original Investigation

Effects of perceptual learning modes in dance education

Katarina Šimunović, Alen Miletić, Đurđica Miletić
Faculty of Kinesiology, University of Split

Purpose: The main goal of the research is to establish whether there is a difference between the research groups (visual, kinaesthetic, and auditory) in progressing through the cognitive stage of learning in dance classes. Effectiveness of self-assessment and preferences in perceptual modes separately by gender were analyzed as a part of the student-centered approach in dance education.
Methods: The study was carried out on a sample of 61 students, aged between 20 and 24, divided into three groups: visual (N=21), kinaesthetic (N=21) and auditory (N=19) in which a different perceptual learning strategy was implemented. The learning progress in the initial cognitive stage of learning and the assessment of dance performance level was monitored through three measurement points. External and internal evaluation of dance skills level of performance was conducted.
Results: Results suggested satisfactory metric characteristics of sensitivity and objectivity of the newly constructed test for assessing external and internal level of dance performance. According to the Repeated Measures ANOVA and Tukey post hoc test between three measurement points with two categorical variables of gender and perceptual learning modes, statistical significance was found, $F(4,110) = 5.442$ ($P<0.001$).
Conclusions: The obtained results suggest that the auditory perceptual learning strategy is the most effective method for learning dances in the cognitive stage of learning. Perceptual learning strategy of following the rhythm and tempo of music is more effective for creating memory patterns formed in the initial stage of learning than relying on visual or kinaesthetic inputs for learning dance patterns. Self-evaluation as well as possibility of choosing an effective perceptual learning strategy are student-centered forms of teaching dances that should be given priority in the learning process.

Keywords: student-centeredness, gender differences, cognitive stage of learning.

Introduction

Learning dances implies the use of visual, auditory, kinaesthetic, and analytic methods of teaching,[1] for which it is necessary to develop separate learning strategies. Effective dance learning is based on the dancer's activity and motivation, which can be enhanced by applying the dancer's or student's preferred perceptual mode. In particular, the activity and motivation of students should be encouraged in dance education in school practice due to the great benefits of the implementation of dance contents in physical education (PE) classes, which can be physiological, psychological and social benefits for students.[2-8] By applying dances content in education, a significant contribution can be made to developing inclusiveness and gender tolerance. Specifically, the education content regarding folk dances includes learning about national heritage, original traditions, and culture, which concerns young people's awareness of their national and cultural identity as the first step in understanding and accepting other nations and cultures. In that way, learning folk dances provides a great opportunity to learn about inclusiveness in practice. Besides general inclusivity, a prominent advantage of dance education is gender tolerance. In order to effectively implement SDG goals through dance education, changes in dance education strategies should be made. A transformation in the educational approach with a greater part of the student-centered approach compared to the classic teacher-centered approach is possible and desirable through dance education. Teacher-centeredness refers to the traditional transfer of knowledge and skills in a learning environment, in which the teacher has the dominant role; while student-centeredness seeks to encourage students' activity and develop their critical thinking skills by using problem-solving methods during the PE classes.[9-11] Main components of student-centered dance teaching classes can be recognized as active participation of students in creating choreography, making decisions about what and how they will learn, creating new dance patterns based on previously learned dance skills, understanding expectations, and using self-assessment evaluations, monitoring their dance improvement to develop strategies for future learning, working in collaboration with other dancers, demonstration of authentic dance performance. The measurability of these categories in education, and thus the effectiveness of the student-centered method itself, has not been sufficiently investigated in previous research. Therefore, in the methodological approach of this research, two categories were specially elaborated: the selection of the preferred perceptual mode of learning and checking the objectivity of the self-assessment model. According to Rothmund (2023)[12] student-centered approach is focused on holistic development through a discovery process and teacher-centered approach is focused on training of dance artists, with an emphasis on skill acquisition in dance technique. The author defines a middle mode for teaching contemporary dance as combination of skill acquisition and personal growth through problem solving methods. Therefore, to better understand which

and when should one of the two approaches be allotted preference during the dance classes, more scientific data obtained during educational processes are needed.

A perceptual mode in motor learning is specific way in which relevant information is received and processed. The students individually preferred learning mode should be considered in organizing the entire learning process in order to achieve the learning goals as effectively as possible. According to Coker (2017)[13] four different modes of perceptual learning (visual, kinaesthetic, analytical and auditory) should be taken into consideration during giving instructions and designing practice environments while planning motor learning. It is precisely the possibility of choosing a perceptual learning mode and then learning through the chosen mode that could contribute to more active participation of students in dance and more efficient progress in learning. On the population of college students,[14-16] preferences in perceptual learning modes were analyzed using the VARK questionnaire, which profiles student preferences through 4 learning modes (visual, auditory, read/write, kinaesthetic). Research in the field, especially in dance education, where perceptual learning can foster students' cognitive, affective and psychomotor development,[17] is still lacking.

The aims of the study

In order to analyse the effectiveness of self-assessment as a part of the student-centered approach in dance education, the first goal of the research is to evaluate and compare external evaluation and self-evaluation of students. The metric characteristics (objectivity and sensitivity) of a newly constructed test for assessing the level of dance performance were analysed, and then the external evaluation of independent experts was compared with self-assessment of students. The hypothesis that student-centered approach elements were applied in the experiment can be accepted if the self-assessment mode is objective and if there is a significant correlation between external and self-assessment of students' evaluation. The second goal of the research is to determine which of the three perceptual learning modes (visual, kinaesthetic, and auditory) will best affect dance performance. In the student-centered approach, it is important to establish whether the possibility of choosing a perceptual learning mode will be consistent with effective learning. The ultimate educational goal is to increase the efficiency of learning by increasing the activity and commitment of students. The third goal of the research is to establish whether there is a difference between the research groups (visual, kinaesthetic, and auditory) in progressing through the cognitive stage of learning. Perceptual sensory pathways will be strongly engaged precisely in the first, cognitive stage of learning; therefore the assumption is that the effects of perceptual learning modes can be better monitored at the very beginning of learning.

Methods

Participants

The research was conducted on a sample of 61 PE students aged 21 to 24, through the Dance course. At the beginning of the teaching process, students were divided into three study groups: a) *visual* (N=21, 10 female students and 11 male students); b) *kinaesthetic* (N=21, 8 female students and 13 male students); c) *auditory* (N=19, 8 female students and 11 male students). Before the beginning of the study, it was determined whether the students had any previous folk dance experience, and those with such experience did not participate in the study. Then, the participants from all groups were given basic information and instructions regarding the study and its objectives; and basic theoretical information regarding *visual, kinaesthetic,* and *auditory* strategies of learning dances. Based on the information received, the students could choose a group, or strategy, with which to learn the dance. Non-random allocation of the sample of subjects was applied in order to respect the preferences of students in choosing a perceptual learning mode. This approach to research was necessary in order to be able to analyze the student-centered method, in which it is essential that the student chooses the contents and learning modalities. Participation in the study was voluntary and participants were informed that they could withdraw at any time.

Study design

The folk dance of the Adriatic dance zone suitable for implementation in PE classes were the learning content of the experiment. Kontradanca is a Croatian dance of the Adriatic dance zone originating from the city of Dubrovnik and belongs to the group of salon dances. The dance is performed in pairs and to the musical accompaniment of a mandolin band in two-quarter time. The male and female dancers are facing in the direction of movement and hold each other with their right hands. For the purpose of evaluation, the dance evaluation form was broken down into basic sequences or parts, and each sequence was evaluated with a score of 2 (if part of the sequence was performed correctly), 1 (if the sequence was performed partially correctly), and 0 (the sequence was not performed correctly). The following figures were evaluated: (1) the pair moving forward in a three-step; (2) the pair moving backward in a three-step; (3) 4 balance turns in pairs by 180 degrees; (4) the pair moving forward and backward in a quadrille; (5) the pair changing in a quadrille. The total maximum score for the dance evaluation form was 10. For example, the pair moving forward in a three-step, implies the pair moving forward holding each other's right hands. The dancer's left hand is behind his back, and the woman's left hand is at her side. The couple begins the three-step with their right foot, steps with their left to their right, then steps forward with their right again. The stance is upright, and the movement is to the music in two-quarter time *mezzoforte*. The described evaluation method is common in the scientific environment and is used for evaluation of aesthetic movements.[18,19] External evaluation performed by independent evaluators, and internal evaluation performed by students themselves were carried out according to the same criteria.

In the second phase, students were divided into three research groups (visual, kinaesthetic, and auditory) in which a different approach to learning was implemented. In the *visual* group (N=21) student were acquiring new dance skills mainly by following the demonstrator’s performance and mistakes in the performance were corrected by observing themselves in the mirror. In the learning strategy, visual stimulation was used as much as possible. In the *kinaesthetic* group (N=21) instructional strategies such as guidance were applied. The students in this group were supposed to let themselves be led in the dance. The basis of the kinaesthetic learning strategy is the direct experience of movement and learning through kinaesthetic stimuli. In the *auditory* group (N=19) students were acquiring new dance skills mainly by following the rhythm and tempo of the music or by following the teacher’s clapping to given rhythm. In the learning strategy, auditory stimulation was used as much as possible. The dance patterns in all three research groups (visual, kinaesthetic, and auditory) were the same. This approach in dance education is known as the VAK model in the previous literature in learning traditional dances;[20] in which, through variations of visual, auditory, and kinaesthetic stimuli, students are encouraged to become more actively involved in the learning process.

At the very beginning of learning in the cognitive stage of acquiring new motor skills, three independent judges assessed the learning progress of each individual student. In addition to dance knowledge itself, which was assessed on a scale of 0 to 10, the judges also checked the expressiveness of the performance and the dance style (0-3) and the harmony of the dance performance with the music (0-3). In this way, performance accuracy and spatial awareness as well as the coordination of steps and music were rated. Thus, the total assessment range within which the judges could monitor learning progress was from 0 to 16. Progress was monitored at three time points during the first week of learning. The judges assessed the students' performance three times (S1, S2, S3) during a period assumed to represent the cognitive stage of learning, namely, the first measurement was conducted during the first class, the second measurement was conducted during the second class, and the third measurement was conducted during the third class of learning on a scale of 0-16.

Statistical analysis

The methods for data analysis were chosen according to the set of goals of the research, to analyse the metric characteristics of the newly constructed tests for assessing the level of performance of the dance. In order to analyse the sensitivity, descriptive statistical parameters were calculated: arithmetic means (AS), standard deviations (SD), minimum scores (MIN), maximum scores (MAX), and the normality of distributions was checked with the Kolmogorov-Smirnov test (KS). In order to analyse the objectivity of the judges, the Cronbach alpha coefficient was calculated. In order to determine which of the three perceptual learning modes will best affect dance performance, a two-way analysis of variance (Factorial ANOVA) was used with the independent variables of: a) gender (male and female students) and b) perceptual modes (visual, kinaesthetic and auditory). Finally, for assessing differences between the research groups (visual, kinaesthetic, and auditory) in progressing through the cognitive stage of learning (S1, S2, S3), a Repeated Measures ANOVA was used with the two independent variables of gender and perceptual modes. The Tukey Post Hoc Test was used to determine significant differences among means. The level of significance was set at $P<0.05$. Statistica 13.0 (TIBCO Software Inc, USA) was used for all analyses and a *P-level* of 95% was applied

Results

For the assessment of the first goal of the research, namely the evaluation and comparison of external evaluation and self-evaluation of students, the objectivity and sensitivity of the newly constructed test for assessing the level of dance performance were analysed (Table 1). According to descriptive statistics and KS test, newly constructed test for assessing the level of dance performance has satisfactory metric characteristics of sensitivity. According to the KS test results for all three dance evaluators as well as the final variable does not deviate significantly from the Gaussian curve at the error level of 0.05 and results were normally distributed. According to correlations between three evaluators the results of the Cronbach alpha coefficients (alpha =.86), test for assessing the level of dance performance shows satisfactory measurement characteristics of objectivity. The results of the mean values of arithmetic means in self-evaluation (7.98) are higher than in external evaluation (7.68). The correlation between two variables: (1) external evaluation assessed by three independent judges and (2) internal evaluation (students' self-assessment) is significant and moderate (0.39; $P<0.01$). Students use a lower range of grades (5-10) in self-evaluation than external evaluators (2-10).

Table 1. Variables of external evaluation (E1. E2, E3) and self-evaluation of dance performance: descriptive statistics, values of the Kolmogorov-Smirnov test (KS) and correlations between evaluators .

evaluators	Mean	Min	Max	SD	KS*	Correlations** - evaluators		
						S1	S2	S3
E1	7.48	2.00	10.00	2.29	.20	1.00	0.69	0.67
E2	7.77	4.00	10.00	2.01	.19	0.69	1.00	0.65
E3	7.84	3.00	10.00	2.15	.20	0.67	0.65	1.00
Total	7.69	3.67	10.00	1.90	.13	0.90	0.88	0.88
Self-evaluation	7.98	5.00	10.00	1.51	.17	0.33	0.23	0.48

*KS test is significant on the level of 0.05 for: d<0.21 (when N=61)
** correlations are significant at p < .05

The selection of the preferred perceptual mode of learning and the possibility of student choice are the second analysed segment of the student-centered approach. The second objective of the study was to determine which of the three perceptual learning modes (visual, kinaesthetic, and auditory) will best affect dance performance, was analysed to determine the influence of individual perceptual modes on successful dance performance, taking into account gender specificity. In order to determine which of the three perceptual learning modes (visual, kinaesthetic, and auditory) will best influence students' dance performance separately by gender, the two-way analysis of variance (Factorial ANOVA) was calculated. According to the results obtained, significant main affect of learning mode was found ($F(2,55) = 5.60$; $P<.006$), and the auditory group outperformed the visual and kinaesthetic groups.

The improvement of dance performance through cognitive stage of learning was analysed in three measurement points for all three study groups (visual, kinaesthetic, and auditory). The results of the mean values and standard deviations of the subjects, achieved in the three measurement points, separately by gender are shown in Table 2.

Table 2. Descriptive statistics of variable for assessing dance performance progress in cognitive stage (three measurement points S1, S2, S3) according to gender.

	First measurement	Second measurement	Third measurement
	S1	S2	S3
	Mean ±SD	Mean± SD	Mean ±SD
Male (N= 35)	4.33±2.45	6.81±1.65	7.70±2.53
Female (N=26)	4.37±2.80	7.53±2.58	9.00±3.26
Total (N=61)	4.35±2.58	7.11±2.11	8.26±2.91

According to Repeated Measures Analysis of variance presented in Figure 1, and two categorical variables of gender and perceptual learning modes, statistically significant effects were found F (4,110) = 5.442 (*P<0.00*). The Tukey Post Hoc Test significant differences results of research groups between measurement points and between groups in the same measurement point for all three perceptual mode groups (males and females separately) in three measurement points during cognitive stage of learning were presented in Table 3.

Table 3. Mean values and standard deviations (M ± SD) and Tukey Post Hoc Test significant differences results of research groups between measurement points ($^{A-E}$) and between groups in the same measurement point (*) for all three perceptual mode groups (males and females separately) in three measurement points during cognitive stage of learning (S1, S2, S3).

	Visual			Kinaesthetic			Auditory		
	male n=11	female n=10	total n=21	male n=13	female n=8	total n=21	male n=11	female n=8	total n=19
S1	3.97±3.03^{A}	3.30±2.09^{B}	3.65±2.59	5.18±2.35	4.67±1.33^{C}	4.98±2.00	3.70±1.75^{D}	5.42±4.20^{E}	4.42±3.05
S2	7.30±1.85^{A}	8.40±1.88^{B}	7.83±1.90	6.26±1.69	6.29±3.04	6.27±2.22	6.97±1.33^{D}	7.67±2.68^{E}	7.26±1.97
S3	7.94±2.41^{A}	7.80±1.34^{B}	7.87±1.92	7.10±3.09^{a}	8.29±4.05*	7.56±3.44	8.18±1.93^{D}	11.21±3.31^{E*}	9.46±2.95

Significant differences between groups in the same measurement point: *female auditory and male kinesthetic group p<0.04;

Significant differences between measurement points: ^{A}male visual group between S1 and S2 (p<0.00); S1 and S3 (p<0.00); ^{B}female visual group between S1 and S2 (p<0.00); S1 and S3 (p<0.00); ^{C}female kinesthetic group between S1 and S3 (p<0.01); ^{D}male auditory group between S1 and S2 (p<0.00); S1 and S3 (p<0.00); ^{E}female auditory group between S1 and S3 (p<0.00);S2 and S3(p<0.00).

In the first measurement point, in which the dance performance was analysed in the first lesson, there are no significant differences between the research groups, which confirms the initial thesis that all subjects started the experiment without significant differences in previous dance skills. Additional significant differences identified by the Tukey post hoc test were noted as follows, between: the male visual group in the first measurement and the male auditory group in the third measurement (*P<0.01*); the male visual group in the first measurement and the male kinaesthetic group in the third measurement (*P<0.03*); the male visual group in the first measurement and the female auditory group in the third measurement (*P<0.00*); the male visual group in the first measurement and the female visual group in the second measurement (*P<0.01*); the female visual group in the first measurement and the male kinaesthetic group in the third measurement (*P<0.04*); the female visual group in the first measurement and the male auditory group in the third measurement (*P<0.00*); the female visual group in the first measurement and the male visual group in the second measurement (*P<0.03*) and the third measurement (*P<0.00*); the female visual group in the first measurement and the female kinaesthetic group in the third measurement (*P<0.01*); the female visual group in the first measurement and the female auditory group in the second (*P<0.03*) and the third measurement (*P<0.00*); the male kinaesthetic group in the first measurement and the female auditory group in the third measurement (*P<0.00*); the female kinaesthetic group in the first measurement and the female auditory group in the third measurement (*P<0.00*); the male auditory group in the first measurement and the female auditory group in the third measurement (*P<0.00*).

Significant differences were noted within one research group between different measurement points in the cognitive stage, in all groups except the male kinaesthetic group (Table 3). Significant differences show a positive progression in dance performance across time points in the cognitive stage in all research groups except the female visual group. In the female visual group, the arithmetic means increase from the first (3.30) to the second measurement point (8.40), and then numerically decrease at the third measurement point (7.80).

Differences within one measurement point between different groups were noted only between the female auditory and the male kinaesthetic group in the third measurement point (*P<0.04*) in favour of the female auditory group.

Regarding the second measurement point or the second lesson of dancing, the Tukey Post Hoc Test showed significant differences between the male kinaesthetic group in the second measurement and the female auditory group in the third measurement (*P<0.00*).

According to the results of the Tukey Post Hoc Test between different measurement points, the only significant difference between measurement 2 and 3 was recorded in the female auditory group (*P<0.00*), but there were no significant differences between the first and second measurements in the female auditory group.

According to the results shown in Table 3, respecting gender differences, the best results in dance performance in the first measurement are shown by the female auditory group and the male kinaesthetic group. In the second measurement, the best progress is shown by the males and females in the visual group. In the third measurement, the most successful in dance performance are the male and female students in the auditory group.

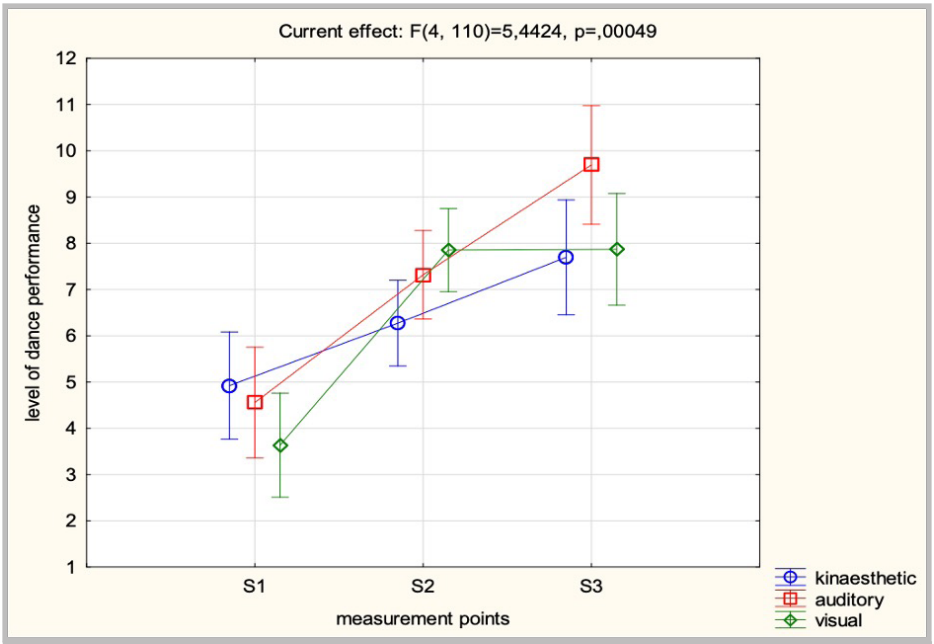

Figure 1. Differences between measurements in the cognitive stage of learning (S1, S2, S3) in the overall sample of participants (female and male students together) in all three study groups (visual, kinaesthetic, auditory).

Discussion

According to the set research objectives, the discussion is presented in three sub-chapters: Self-assessment as a tool for student–centered approach implementation, preferred perceptual mode of learning in dance education and cognitive stage of learning and preferred perceptual modes.

Self-assessment as a tool for student–centered approach implementation

Dances of the Adriatic dance zone are generally characterized by coordination complexity.[21,22] Frequent changes in direction of movement, the number of images and characteristic movement communication with the other couples contributed to dance complexity from a cognitive and sociological perspective. Clear and transparent criteria for dance evaluation and self-evaluation are all the more necessary before further analyses. The students' use lower range of grades for self-evaluation compared to external evaluators is understandable due to the level of dance skills and the ability to notice details due to the perspective of an external observer [23]. Although there is still work to be done on creating a universal variable that will have a better connection between external and internal judgments, the presented results show an objective self-assessment of students that can be used in the measurement of a student-centered approach efficiency in dance education. In accordance with results and discussion for the first research goal, the hypothesis that student-centered approach was applied in the experiment can be accepted as an effective self-evaluation segment during dance learning. In conclusion, self-assessment as a tool for student-centered approach implementation can be applied in dance education for students and can be a tool in the educational transformation from the classic teacher-centered approach to the student-centered approach. The ultimate goal of introducing self-evaluation in dance education as part of the student-centered approach is not to replace external evaluation, but to increase student activity. The assumption is that such an approach will contribute to the active learning of dance structures and the greater interest of students in dance content. In subsequent research, it is necessary to analyse other elements of the student-centered approach, such as critical thinking skills by using problem-solving methods[9-11] in order to have a better insight into the effects of the active approach of students and the overall educational benefits of the student-centered approach in dance. For the analysis of the educational effects in this research, the self-assessment method should be viewed together for the possibility of choosing a perceptual learning strategy and transparent monitoring of dance improvement, which will help to monitor and improve the preferred strategy. Choosing a perceptual learning strategy is an important element of a student-centered approach in education. At the same time, non-random allocation affects generalization and inference, which can be used in large samples and not only in single-institution samples to compare the results.

This enables the student to actively participate in developing strategies for future learning and working in collaboration with other dancers, key elements of active learning in dance education. The applied learning strategy can be considered a middle mode between the student-centered and teacher-centered approach that Rothmund (2023)[12] defined as a combination of skill acquisition and personal growth through problem-solving methods.

Preferred perceptual mode of learning in dance education

In the first phase of the research, five basic dance sequences were evaluated. Each sequence was evaluated with a score of 2 (if part of the sequence was performed correctly), 1 (if the sequence was performed partially correctly) and 0 (the sequence was not performed correctly). Female dancers achieved the best dance performance results in the auditory group, while male dancers achieved the highest performance results in the visual group. The lowest dance performance results were recorded in female dancers in the visual group and in male dancers in the kinaesthetic group. Previous studies have noted gender differences in dance performance and motivation for dance activities[24-27] but there is no previous research that can confirm gender differences in successful dance performance related to the selected perceptual learning modes. According to Bostanci, Ö. (2020)[14] kinaesthetic learning is the most dominant learning style of sport sciences students, but the results were not analysed separately by gender. In the kinaesthetic group, learning through dance leadership dominated. When learning dance steps, students were supposed to let themselves be guided more quickly by the teacher. For the male population, the mode of learning strategies

in which they follow the lead, either from a teacher or a more experienced dancer, is not the most effective learning mode. Furthermore, learning dance by observing a demonstrator is a more effective mode for male students than for female students. In general, female students in this study acquired dance skills more effectively by listening to the music and rhythm and by following, rather than just watching a demonstrator. Having only visual demonstrations available in the learning process could be an insufficient source of the information needed to develop a memorial representation of the complex skill for female students. The results obtained are in accordance with Las Heras-Fernandez et al (2025)[28], according to which female dancers are more successful in the performance of traditional dance, but further research is needed to investigate the impact of gender differences on emotional intelligence skills in learning dance, which may be related to the preferred learning mode.

Cognitive stage of learning and preferred perceptual modes

Fitts and Posner (1967)[29] suggest three learning stages defined by the behavioural tendencies learner display at various points throughout the learning process can be divided into the cognitive, associative and autonomous stages. At the beginning of the learning process, the learner is first introduced to the dance patterns, and the first task is to understand and develop the requirements of the movement. For the conducted research, it is crucial to establish that prior skills and experience do not influence the cognitive processes of learning new dance patterns. Since the first measurement, which was conducted during the first dance lesson, did not register any differences between the research groups, we can conclude that the students in all three groups are at the same cognitive stage of learning. High degree of cognitive activity is characterized by high attentional demands and limited movement execution. Performance is inconsistent and contains numerous errors, which are typically gross in nature.[13,30] Precisely in this period, it is important to determine whether there are differences in the perceptual mode of acquiring dance skills in order to apply an effective learning strategy. In the second phase of the research, in order to be able to follow the progression in the three measurement points, the evaluators additionally assessed the expressiveness of the performance and the dance style (0-3) and the harmony of the dance performance with the music (0-3) with final range of evaluation from 0 to 16. Male students initially prefer a kinaesthetic perceptual mode, but do not progress to learning through that mode. A kinaesthetic perceptual mode in which following the lead of another dancer is not the best strategy for male beginners because they do not have enough skills for the leading, and an educational environment in which they only follow a partner does not lead to improvement in dance performance. In terms of the way the kinaesthetic perceptual mode strategy works in dance, it can be compared to the reciprocal learning style. Although in previous studies the reciprocal style in dance proved to be effective in comparison to command and self-check styles because female students felt more competent than male students in making decisions, choosing content and generally in influencing the flow of work in class.[19,31] Reciprocal style has the characteristics of a kinaesthetic perceptual mode in the phase of mistake correction when the students were put in pairs and the process was carried out by one pair void in the dance and correcting the mistakes of the other. According to the presented results, the kinaesthetic perceptual mode, especially for the male population, is not a suitable learning mode in the cognitive stage. Students who used visual learning strategies make the fastest progress, but the effects of progress are short-lived. In the third measurement, stagnation occurs, which is especially pronounced in the female population. The plateau in the progression through the cognitive stage of acquiring dance skills occurs only in the female visual group. Further research is needed so that this result could be generally perceived as gender differences in motor learning through watching the demonstrator. But in everyday dance practice, it can be recommended to emphasize auditory cues (music/rhythm) at the beginning of learning, more than watching the demonstrator, especially for female dancers.

Ultimately, the best progress in learning when it comes to the cognitive stage of learning is shown by male and female students who acquired dance skills through auditory strategies by following rhythm and tempo of music or by following the teachers clapping to given rhythm. Memory patterns formed in the initial hours of learning stimulated by music and rhythm contributed to learning progress better than relying on visual inputs by watching demonstrator.

Practical application

The practical implications of the results highlight aspects for the measurability of two categories in education, and thus the effectiveness of the student-centered method in everyday dance practice: self-evaluation and the possibility of choosing perceptual learning strategies. The results of the study confirm that it is possible to monitor the effects of learning in the process of transformation from teacher-centered to student-centered approach in order to increase active student participation in learning, with the best possible final outcome. It is recommended that educational practice should use adaptation mechanisms focused on the specific needs of students, with an emphasis on the role of student activity, responsibility and critical thinking skills. Respecting students' objective evaluation and preferences of learning strategies that we know will lead to good results and especially gender differences detected in this study can increase student engagement in line with a student-centered approach and thus contribute to innovating the academic curricula for physical education students. The results of the research clearly show that auditory perceptual learning strategy should be used in the cognitive stage of learning in order to achieve the best progress in dance.

Study limitations

Although this study provides a basis for further research on the influence of perceptual learning modes on success in dance and the use of self-evaluation of students as part of student-centered approach in dance education, it is necessary to acknowledge the observed limitations. When interpreting the results, it is important to take into account the way in which the research groups were formed according to the students' preferences. Non-random allocation of the sample of subjects was applied in order to respect the preferences of students in choosing a perceptual learning mode but the generalisation of the obtained data is then limited. The motivation for choosing groups could have varied, for example, by the partner with whom they wanted to dance. Therefore, further research should also include the area of student motivation together with the preferences for learning strategies in dance. It is important to emphasize the small sample size in subgroups due to the decrease in the number of respondents during the three measurement points. Although this is a pilot study for analysing students' perceptual preferences in dance education, the sample is too small to form the basis for relevant conclusions, but it can be regarded as an initial step and a foundation for the development of future research. Furthermore, this study was conducted on a single-institution sample, because in the research on motor learning in the cognitive stage, it is important that the learning process in different research groups is as similar as possible. In this way, the same teacher led the

learning process in all three research groups, the duration of learning and material conditions were exactly the same for all three groups. However, the small group size affects the generalization of the results, and research on larger and more diverse samples of subjects are needed to confirm the results obtained.

Conclusions

The self-assessment method, the possibility of choosing a perceptual learning strategy and the transparent monitoring of dance improvement are important elements of the student-centered approach in dance education and can be applied in physical education curricula for effective monitoring of progress with the aim of an active approach to learning. Student-centered forms of teaching dances may be prioritized during the cognitive stage, pending confirmation in larger samples. Especially, the auditory perceptual mode and learning strategy seems to be the most appropriate when learning to dance in the cognitive stage of learning. The correct choice of the effective dance teaching perceptual mode can improve the overall learning process in accordance with requirements of modern education and high-quality physical education lessons and classes that are enjoyable, well-structured, and meaningful.[32] According to results obtained in this research, there are gender differences in the perceptual strategies of dance learning and progression in the cognitive stage of learning among adult beginners. Auditory learners showed the largest improvement, while female students who acquired dance skills through visual strategies and male students through kinaesthetic strategies, progressed more slowly. In the female visual perceptual group, significant progress was recorded at the beginning, but stagnation in the second phase of the cognitive stage of learning was evident. Further research on larger and more diverse sample of subjects would be necessary in order to select an appropriate perceptual teaching strategy in accordance with student motivation, age and gender.

Acknowledgments

This research was supported by the University of Split, Institutional Project "Health, Longevity & Sport" (HeLoS), Grant No: IP-UNIST-24.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Ethical Committee approval

2181-205-02-05-25-021.

ORCID

Katarina Šimunović n/a
Alen Miletić https://orcid.org/0000-0002-4354-7466
Đurđica Miletić https://orcid.org/0000-0001-7920-4644

Topic

Sport Science, Sport performance

Conflicts of interest

The authors have no conflicts of interest to declare.

Funding

No funding has been received for this scientific research.

Author-s contribution

Conceptualisation, K. Š. and Đ.M.; methodology, Đ. M. and A. M.; software, A. M.; validation, K. Š. and Đ.M.; formal analysis, Đ. M. and A. M.; Investigation, K. Š., Đ. M. and A. M.; resources A. M.; data curation, Đ. M. and A. M.; writing- original draft preparation, K. Š., Đ. M. and A. M; writing – review and editing, K. Š., Đ. M. and A. M; supervision; K. Š., Đ. M. and A. M: project administration, Đ. M. and A. M. All authors have read and agreed to the published version of the manuscript.

References

1. Miletić A. Distance learning in dance sport during the Covid-19 outbreak. *Acta Kinesiol*. 2022;16(1):18. doi:10.51371/issn.1840-2976.2022.16.1.18
2. Stivaktaki C, Mountakis C, Bournelli P. The effect of a cross-curricular study programme in physical education on the attitudes and perceptions of Greek children towards traditional (folk) dance in the first year of secondary school. *Res Dance Educ*. 2010;11(3):193-211. doi:10.1080/14647893.2010.532868
3. Mattsson T, Lundvall S. The position of dance in physical education. *Sport Educ Soc*. 2013;20(7):855-871. doi:10.1080/13573322.2013.837044
4. Gibbs B, Quennerstedt M, Larsson H. Teaching dance in physical education using exergames. *Eur Phys Educ Rev*. 2016;23(2):237-256. doi:10.1177/1356336x16645611
5. Gallegos AG, López MG. La motivación y la inteligencia emocional en secundaria. Diferencias por género. *Int J Dev Educ Psychol.* 2020;1(1):101-110. doi:10.17060/ijodaep.2020.n1.v1.1766
6. Neville RD, Makopoulou K. Effect of a six-week dance-based physical education intervention on primary school children's creativity: A pilot study. *Eur Phys Educ Rev*. 2020;27(1):203-220. doi:10.1177/1356336x20939586
7. Mattsson T, Larsson H. 'There is no right or wrong way': exploring expressive dance assignments in physical education. *Phys Educ Sport Pedagog*. 2020;26(2):123-136. doi:10.1080/17408989.2020.1752649
8. Fountzoulas GK, Nikolaki E, Koutsouba MI. Action Research in Greek Traditional Dance: Implementation and Self-Reflection. *Eur J Humanit Soc Sci*. 2023;3(3):32-39. doi:10.24018/ejsocial.2023.3.3.446
9. Serin H. A comparison of Teacher-Centered and Student-Centered approaches in educational settings. *Int J Soc Sci Educ Stud*. 2018;5(1). doi:10.23918/ijsses.v5i1p164
10. Matsuyama Y, Nakaya M, Okazaki H, Lebowitz AJ, Leppink J, van der Vleuten C. Does changing from a teacher-centered to a learner-centered context promote self-regulated learning: a qualitative study in a Japanese undergraduate setting. *BMC Med Educ*. 2019;19(1):1-12.
11. Shah RK. Concepts of Learner-Centred Teaching. *Shanlax Int J Educ*. 2020;8(3):45-60. doi:10.34293/education.v8i3.2926
12. Rothmund IV. Student-centred learning and dance technique: BA students' experiences of learning in contemporary dance. *Res Dance Educ*. June 2023:1-20. doi:10.1080/14647893.2023.2230135
13. Coker CA. *Motor learning and control for practitioners*.

Routledge; 2017.
14. Bostanci Ö. Learning style preferences of prospective teachers of physical education and sport. *Asian J Educ Train*. 2020;6(2):231-236. doi:10.20448/journal.522.2020.62.231.236
15. Alkooheji L, Al-Hattami A. Learning Style Preferences among College Students. *Int Educ Stud*. 2018;11(10):50. doi:10.5539/ies.v11n10p50
16. Hernandez JE, Vasan N, Huff S, Melovitz-Vasan C. Learning Styles/Preferences among Medical Students: Kinesthetic Learner's Multimodal Approach to Learning Anatomy. *Med Sci Educ*. 2020;30(4):1633-1638. doi:10.1007/s40670-020-01049-1
17. Dahliana LH, Jaelani A, Rokhmah UN. The impact of the visual, auditory, and kinesthetic model on motivation and learning outcomes of Islamic Elementary School students. *J Integr Elem Educ*. 2023;3(2):150-163. doi:10.21580/jieed.v3i2.16867
18. Miletić Đ, Božanić A. The subjective exercise experiences before and after physical activity among university students. In: *Sci Commun 7th FIEP Eur Congr*; 2012:493-496.
19. Miletic D, Miletic A, Uzunovic S. The effects of reciprocal, self–check, and command teaching styles on dance learning. *Phys Educ Stud*. 2023;27(5):261-269. doi:10.15561/20755279.2023.0506
20. Sutini A, Agustin S, Mustika S. The VAK Model in Cultural Arts and Craft Learning: An effort to enhance understanding of the dynamic movement of Tari Umbul in elementary school education. *J IQRA*. 2025;10(2):287-300. doi:10.25217/ji.v10i2.6522
21. Srhoj L. Effect of motor abilities on performing the Hvar folk dance cicilion in 11-year-old girls. *Coll Antropol*. 2002;26(2):539-543.
22. Miletic A, Miletic D, Kalinski SD. The effects of student-centred learning methods and motivational climate on dance learning. *Sport Mont*. 2023;21(3):37-43. doi:10.26773/smj.231006
23. Kulis S, Chren M, Gajewski J. Kinematic analysis of sway motions of elite dance sport competitors. *Acta Kinesiol*. 2024;17(1):60-65. doi: 10.51371/issn.1840-2976.2023.17.1.9
24. Anderson SD, Leyland SD, Ling J. Gender differences in motivation for participation in extra-curricular dance: application of the Theory of Planned Behaviour. *Res Dance Educ*. 2017;18(2):150-160. doi:10.1080/14647893.2017.1330325
25. Andreoli GS. Dance and Gender Relations: A Reflection on the Interaction between Male and Female Students in Dance Classes. *J Educ Soc Policy*. 2019;6(1). doi:10.30845/jesp.v6n1p16
26. Mateu M, Garcías S, Spadafora L, Andrés A, Febrer E. Student Moods Before and After Body expression and dance assessments. Gender Perspective. *Front Psychol*. 2021;11:612811. doi:10.3389/fpsyg.2020.612811
27. Coronel AJ, Tiglao RM, Solayao R, Lobo J. Gender and Dance Motivation as determinants of Dance Style choice. *Am J Arts Human Sci*. 2022;1(1):34-37. doi:10.54536/ajahs.v1i1.281
28. De Las Heras-Fernández R, Cuellar-Moreno MJ, Mateos ME, Acero JMA. The influence of teaching styles on the emotions of university students in dance lessons according to sex. *Res Dance Educ*. 2022;26(2):182-201. doi:10.1080/14647893.2022.2144197
29. Fitts PM, Posner MI. Human performance. Brooks/Cole; 1967.
30. Kezić A, Miletić Đ, Kujundžić Lujan I. Motor learning in rhythmic gymnastics: influence of fundamental movement skills. *Acta Kinesiol*. 2018;12(2):20-28.
31. Chatoupis C, Vagenas G. Effectiveness of the practice style and reciprocal Style of Teaching: A Meta-Analysis. *Phys Educ*. 2018;75(2):175-194. doi:10.18666/tpe-2018-v75-i2-7920
32. Tao D, Gao Y, Li F, et al. Physical education provision in schools. A role for dance. *Phys Act Health*. 2022;6(1):38-41. doi:10.5334/paah.137

Corresponding information:
Received: 31.12.2025.
Accepted: 04.02.2026.
Correspondence to: Katarina Šimunović
University: Faculty of Kinesiology; Nikole Tesle 6, Split 21000, Croatia
E-mail: katarinasimunovic2001@gmail.com