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Original Article

The level of selected motor-cognitive abilities of young female professional dancers in the context of perfectionism

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Abstract:
Problem Statement: Dance is a physical activity that combines multiform movement with synchronization to music. It requires specific cognitive skills and personality traits. The main contribution of this paper was to investigate the relationship between perfectionism and motor-cognitive abilities. *Approach*: 31 junior female dancers aged 13-16 years participated in the presented study. Dancers are members of two dancing teams, which regularly participate in National Championships, Europe Championships, World Championships and World Cups in Show Dance and Jazz Dance. *Methods*: To measure cognitive abilities Vienna Test System and tests: ZBA/S3, 3D/S1, 2HAND/S4 were used. The Perfectionism in Sport Questionnaire (PSQ) was completed by dancers. *Results*: Perfectionism scores were categorized into groups below and above the median.Within these groups, the results of the Vienna Tests were analyzed. Statistical analysis showed statistically significant differences in the variables of the anticipation test in the median groups of negative perfectionism. Results were recorded for the ZBA/S2 test, for which three significant differences for parameters MEDDFK (p=0,019), MEDTFE (p=0,027) and MEDTFG (p=0,035) are significantly higher in the >Me negative perfectionism group. Also forward regression analysis for positive perfectionism showed that the optimal input set includes four variables. The variables ZBA/S2 - MEDTFK and 3D/S1 - WA have negative weights in the model which suggests that the higher the value of these variables is associated with lower positive perfectionism. The remaining variables have positive weights which implies that the higher is their value, the higher the level of positive perfectionism is. *Discussion*: In our approach to perfectionism it is essential to look at dance as a sport, not as divided areas. The personality trait like perfectionism, that is acquired through experiences and interactions with the environment, can subconsciously modify the cognitive response in specific situations. The relationship between perfectionism and cognitive area is still not completely unexplored. *Conclusions*: Perfectionism can be related to cognitive abilities. There is a space for diagnosing and projecting cognitive trainings in connection to this discipline in young children to support cognitive development not only in general but in alignment with sports. Anticipation should be as effective as possible, and additional factors of the individual, like perfectionism, can modify it. If one incorporates this knowledge into the practical work more exercises can be designed for dancers to make more effective decisions in a limited space.
Key Words: **cognitive processes, perfectionism, dancers, Vienna Test System.**

Introduction

Contemporary dancing is a physical activity that connects multiformed movement with synchronicity to music (Basso et al., 2021). It requires processing a very large amount of information at the same time (Jola et al., 2011). Besides of physical activity it contains motor coordination (Anjos and Ferraro, 2018), sensorimotor synchronization (Su, 2016) and cognitive skills (Hamacher et al., 2015). It requires very precise and smooth movements to make the whole performance look good visually (Sheets-Johnstone, 2012). During dance routine mental representation is important for controling actions and analyzing information from space in relations to movement (Bläsing et al., 2009). Dancers need to have cognitive abilities at the right level to combine movement, information from the environment and synchronization with partners. This discipline demands a combination of motor and cognitive skills to be able to process information internally and show the result externally (Hamacher et al., 2015). As previous studies showed jazz dance training improves some motor and cognitive skills (Alpert et al., 2009) and cognitive flexibility (Coubard et al., 2011). But not only cognitive but also personality traits can be related to dance (Knoblich, 2007). Complex contemporary dance routine is related to psychological processes, personal experience and individual traits (Stevens, McKechnie, 2005). Thus, some psychological traits like perfectionism are more desirable in dancers (Flett and Hewitt, 2014).

Perfectionism is a personality characteristic (Flett and Hewitt, 2002), it can be analyzed in addition to different area of life and should not be subjected to analysis without regarding to other factors (Quested, 2014). Perfectionism can be considered in the positive aspect including high personal standards and striving for perfection as well as the negative as constant reflecting on mistakes and pressure (Stoeber and Otto, 2006). As

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Cumming and Duda (2012) presented in their model, there are several types of perfectionism, depending on emphasized factors. But the perfectionism as a trait can be divided into positive and negative. Positive is described as a characteristic which is as helpful, necessary to grow and gain achievements. Negative is related to disturbing and excessive concern about mistakes (Waleriańczyk and Stolarski, 2016). As the previous research showed the predominant type of perfectionism for dancers is high personal standards, moderate concerns over mistakes, and low doubts about actions (Cumming and Duda, 2012). Perfectionism could be also examined in connection to motivation for dancing (Nordin-Bates et al., 2017).

Children who practice dance presented better motor skills and coordination compared to children who do not practice (Carmen et al., 2020). Research conducted by (Grigore, 2014) on junior dancers has shown that the implementation of appropriate training activities incorporating specific and non-specific tasks particular to dance can enhance psycho-motor abilities. It is well known that reactions with the dominant hand are faster and more accurate (Badau et al., 2018). Eye-hand coordination is an cognitive ability, which can be developed by exercise frequency to perform more fluidly in this area (Chang et al.). Specific dance training supports the development of ambidexterity, which was examined on junior dancers (Florica, 2017). There is a significant difference in eye-hand coordination between those who train eye-contact sports and non-eye-contact sports like dancers (Grigore et al., 2012). It is expected that dancers should have lower a level of this ability.

Peripheral vision is especially needed for motion detection and processing. It helps to direct gaze in conjunction with the analysis of stimuli relevant to attention (Tang Poy and Woolhouse, 2020). It describes perception of environment, which are out of central part of visual field (Muiños and Ballesteros, 2018). Athletes no matter what age have higher level of this skill than non-athletes (Muiños and Ballesteros, 2015).The eye fixation in those who dance is shorter than in those who have not any dance experience (Stevens et al., 2010). By using this kind of vision dancers can be more focused on outside stimuli, be aware of there surroundings and have better external and internal perception (Kasai and Parsons, 2003). Peripheral vision for dancers has also significant meaning for proprioception and being aware of position in space and orientation (Boucher, 2014).

Because of the fact that dancers have better balance and body organization skills in space (Carmen et al., 2020), it is expected that they have better spatial orientation. After analyzing the EEG data, dancers achieved a statistically higher result in the correctness of visual stimulus identification in relation to spatial ability than the fastball sports athletes and the control group (Isoglu-Alkac et al., 2018). Ballet dancers achieved higher results in spatial orientation skills controlled by the triangle completion task (TCT) than non-dancers (Dordevic et al., 2018). It should be taking into account that dancing style is not important to rotation ability (Bonny et al., 2017). Dancers gained significantly higher results in vestibular dependent orienting in space measured by VBM analysis which revealed differences in the structural difference in brain neuroanatomy (Dordevic et al., 2018). People who dance regularly are expected to have better cognitive skills for instance memory and focusing attention and also better coordination (Lakes et al., 2016). On the other hand dancers were examined as slower in cognitive tasks and had a lower level of spatial memory (Burzynska et al., 2017). In dancing it is important to synchronize time with limited space. This kind of information must be analyzed in a timely manner (Stevens et al., 2003). Time and movement anticipation is an ability to predict a path of movement object and how long it takes to arrive at a target point (Williams et al., 1999). This is one of the factors which have an impact of well sport performance (Magill, 2004). Expert dancers anticipating movement of their partners in a better way which also is linked to prediction of action consequences (Calvo-Merino et al., 2010). Also more experienced dancers generate more frequent and adequate movement during improvisations, which are connected to time and movement anticipation ability (Issartel et al., 2017). Their movement are more accurate and precise because of better time feeling (Bläsing et al., 2009). Review of the presented literature put forward the general and specific purpose of the considerations undertaken. The aim of the following study is to examine the existence of a relationship between cognitive functioning in young expert female dancers and the level of perfectionism. For this purpose, specific motor-cognitive functions that are particularly used during the performance of a choreographed routine were selected. After an in-depth analysis, the specific aim was to verify if selected cognitive functions are related to positive and negative perfectionism in young female dancers.

Material & methods

Participants

In the presented study 31 young female dancers were invited as volunteers to take part. Dancers are members of two dancing teams, which regularly participate in National Championships, Europe Championships, World Championships and World Cups in Show Dance and Jazz Dance. The participants were from 13 to 16 years old [SD = 14,8 Me = 15] and have dance classes three or four times a week.

Procedure

The participants were invited into a room, were they took motor-cognitive tests at Vienna Test Systems. There was only one dancer each time in the lab. The duration of the test was between 30 and 40 minutes. After that they completed questionnaires.

Measure - Cognitive abilities.

Vienna Test System was used to measure cognitive abilities which allows for a multifaceted analysis including motor abilities (Schuhfried, 2001). Before performing each test, the participant was familiarized with

the instructions and made an exercise of the test a few times before proceeding to the actual test. There several tests were used: ZBA/S3, 3D/S1, 2HAND/S4, PP-R/S1.

ZBA/S3 (Time/Movement Anticipation).

The test is used to measure the anticipation of time and movement based on the prediction of the route of a moving object. The task of the participant is to evaluate the direction
of movement and speed of the presented objects. The test consists of two activities including time anticipation, which involves evaluating the run time of an object that unexpectedly disappears and must be evaluated when it crosses the end line, and motion anticipation, where in addition the estimated location where the object crosses the end line must be evaluated.

3D/S1 (Spatial Orientation).

The test is used to measure spatial orientation ability. There a spatial figure created from a pair of blocks is presented. The test subject's task is to imagine what the figure looks like when viewed from the direction indicated by the arrow. There is a possibility to choose among 4 options for projecting this figure from the side. The test was performed with a time limit, where one gets within 3 minutes, with a maximum of 30 tasks presented.

2HAND/S4 (Two-Hand Coordination).

The test is used to identify eye-hand coordination. It is a two-dimensional measurement, as it occurs between the eye and hand and also between the right and left hands. The test subject manipulates two joysticks, one of which moves in a vertical direction and the other in a horizontal direction. The task is to follow the path as accurately as possible for ten repetitions, without going beyond the edges.

PP-R/S1 (Peripheral Vision).

A test used to measure peripheral vision. It contains two types of tasks, the test person with the dominant hand throughout the test by moving the joystick has to move object in the display rim, where in the meantime on the wings of the device display vertical light lines on the right and left from time to time. The test subject is supposed to identify this signal by pressing the pedal with foot.

Perfectionism in sport.

In order to measure the perfectionism variable, the Perfectionism in Sport Questionnaire (PSQ) by Waleriańczyk was used. It is the only Polish-language tool to measure this construct and it allows for a reliable measurement, while taking into account the context of the sport and different kinds of disciplines (Waleriańczyk and Stolarski, 2016). The questionnaire contains 30 items. The respondent's task is to refer to the statement using a 5-grade scale where 1 means definitely no, 2 - rather no, 3 - I have no opinion, 4 - rather yes, 5 - definitely yes. It captures the dimension of positive perfectionism (PP) with 13 statements and negative perfectionism (PN) with 17 statements (Waleriańczyk and Stolarski, 2016). The tool has been validated, but research is still underway to normalize the tool. The reliability expressed by Cronbach's alpha for the PP scale is 0.89, and 0.94 for the PN. The tool is relevant and reliable. Negative perfectionism defined as obstructionism, fear of making mistakes, excessive concern about mistakes made, excessive concern about failures suffered, demotivating sense of discrepancy between goals and results. Positive perfectionism is a construct that can be described as helping, includes the categories of high personal standards, focus on improving one's own skills and enjoyment and satisfaction in sports (Waleriańczyk and Stolarski, 2016).

Ethics approval and consent to participate.

The study was conducted with human participants and in accordance with the Declaration of Helsinki, approval of the protocol by the Ethics Committee of the University of Rzeszow/Poland (protocol 10/02/2020) has been obtained. Participants' parents/legal guardians provided their written consent before the study began.

Statistical analysis

The results were presented using the descriptive characteristics (number, mean, standard deviation and median). Normal distribution was verified using Shapiro-Wilk test. Due to the fact that most of the analyzed variables do not have normal distribution non-parametric tests were used. The U Mann Whitney test was used to show statistically significant differences between median groups (perfectionism below and above median). Additionally for positive and negative perfectionism the regression analysis were conducted. To calculate optimum set of predictors the forward regression was used. All calculations and analyzes were performed using the Statistica 13.

Results

First, the perfectionism questionnaire was analyzed (Table 1). The study group was characterized by a mean level of positive perfectionism of 57, while negative perfectionism was 50. Positive perfectionism was characterized by a relatively low dispersion (sd=4) while negative perfectionism was very high (sd=15). Perfectionism scores were categorized into groups below(<Me) and above the median (>Me). Within these groups, the results of the Vienna Tests were analyzed (Table 2). Analyzing the results for the 2HAND/S1 test, one notices a lack of significant differences between the median groups in both positive and negative perfectionism. In positive perfectionism, those above the median scored uncharacteristically higher in all indicators of this test. Also for the 3D/S1 test, no significant differences were observed between the median groups. Individuals in the >Me group, for positive and negative perfectionism obtained lower values for this test

(the exception being 3D/S1 - BT in negative perfectionism). Interesting results were recorded for the ZBA/S2 test, for which three significant differences were observed between the negative perfectionism groups. The parameters MEDDFK, MEDTFE and MEDTFG are significantly higher in the >Me negative perfectionism group. The median positive perfectionism groups do not significantly differentiate the results of this test. The final Vienna Test was the PPR/ S1 test. The results for this test did not show statistical significance in the median groups, however, some regularity can be observed. PP-R/S1 test scores for positive perfectionism are lower for the >Me group, while scores for negative perfectionism are slightly lower for the <Me group. The next stage of the analysis was based on a detailed assessment of the relationship of the results of individual Vienna Tests with the positive and negative perfectionism of the study group. Tables 3 and 4 present the results of a stepwise progressive regression, which was designed to identify the optimal estimators of positive and negative perfectionism.

Forward regression analysis for positive perfectionism (Table 3) showed that the optimal input set includes four variable. The optimal set consists of ZBA/S2 - MEDDFK, ZBA/S2 - MEDTFK, 3D/S1 - WA and 2HAND/S1 - EHC. The variables ZBA/S2 - MEDTFK and 3D/S1 - WA have negative weights in the model which suggests that the higher the value of these variables is associated with lower positive perfectionism. The remaining variables have positive weights which implies that the higher is their value, the higher the level of positive perfectionism is. The multiple correlation coefficient between positive perfectionism and the selected variables has a strength of R=0.59 with a mean estimation error of SEE=3.78. The linear fit coefficient is at a moderate level (R2= 0.34). For Forward regression for negative perfectionism no statistically significant estimators were observed (Table 4). All of the model's coefficients have positive values, indicating that the higher the values are of these samples, the higher the negative perfectionism is. The relationship between negative perfectionism and selected variables showed a lower coefficient value for the co- relationship (R=0.48) than for positive perfectionism. A lower linear fit was also observed (R2= 0.23) and a higher standard error of estimation (SEE= 13,92).

Table 1

Numerical characteristics of the positive and negative perfectionism

	N	x	Me	min	max	sd
Positive perfectionism	31	57	57	48	65	4
Negative perfectionism	31	50	46	26	82	15

Table 2

Numerical characteristics of the Vienna Tests with a breakdown of results above and below the median perfectionism score obtained

Test - variable	Positive perfectionism				p	Negative perfectionism				p	Total	
	<Me		>Me			<Me		>Me				
	x	sd	x	sd		x	sd	x	sd		x	sd
2HAND/S1 - CDIF	1,91	0,44	2,00	0,54	0,622	1,91	0,51	2,00	0,48	0,601	1,96	0,48
2HAND/S1 - EHC	29,95	5,75	32,12	10,43	0,485	30,83	9,17	31,26	8,05	0,890	31,07	8,43
2HAND/S1 - MED	2,36	1,92	2,41	1,96	0,940	2,39	1,88	2,39	1,99	0,998	2,39	1,91
2HAND/S1 - PED	8,74	8,25	9,50	10,27	0,823	9,42	9,22	8,90	9,46	0,879	9,13	9,20
3D/S1 - BT	179,93	1,22	179,69	1,30	0,593	179,79	1,31	179,82	1,24	0,935	179,81	1,25
3D/S1 - CA	13,47	3,78	13,13	4,03	0,810	13,57	3,59	13,06	4,15	0,719	13,29	3,85
3D/S1 - WA	4,00	3,38	3,06	2,49	0,384	4,00	3,72	3,12	2,15	0,415	3,52	2,94
ZBA/S2 - MEDDFE	44,80	27,45	43,13	17,90	0,841	48,36	26,91	40,29	18,48	0,332	43,94	22,64
ZBA/S2 - MEDDFG	76,87	24,70	75,81	22,00	0,902	81,21	25,02	72,29	21,01	0,289	76,32	22,95
ZBA/S2 - MEDDFK	170,40	57,04	182,31	62,73	0,585	149,64	23,93	198,71	70,60	0,019*	176,55	59,35
ZBA/S2 - MEDTFE	1,25	0,92	1,09	0,81	0,599	0,80	0,37	1,47	1,02	0,027*	1,17	0,86
ZBA/S2 - MEDTFG	1,29	0,83	1,04	0,62	0,350	0,86	0,36	1,40	0,86	0,035*	1,16	0,73
ZBA/S2 - MEDTFK	1,46	0,87	1,01	0,51	0,085	1,01	0,46	1,40	0,87	0,140	1,22	0,73
PP-R/S1 - ANG	164,70	22,40	157,85	23,77	0,417	160,72	26,54	161,53	20,50	0,924	161,16	23,01
PP-R/S1 - ANGL	84,55	13,12	80,39	11,24	0,351	82,22	13,91	82,55	10,96	0,941	82,40	12,16
PP-R/S1 - ANGR	80,13	11,41	77,45	13,73	0,560	78,47	13,46	78,98	12,13	0,913	78,75	12,53

$\bar{x}$ – Mean value; sd – Standard deviation value; p – probability of U Mann Whitney test; <Me – group bellow median value; >Me – group above median value; 2HAND/S4 - Two-Hand Coordination; CDIF - Coordination

impediment; EHC - Eye-hand coordination; MED – mean errors detected; 3D/S1 - Spatial Orientation; PED - Percentage errors detected; BT - Time; CA - Correct answers; WA - Wrong answers; ZBA/S3 - Time/Movement Anticipation; MEDDFE - Median movement deviation on straight track ; MEDDFG - Median movement deviation; MEDDFK - Median movement deviation on complex track; MEDTFE - Median time deviation on straight track; MEDDFG - Median time deviation; MEDTFK - Median time deviation on complex track; PP-R/S1 -Peripheral Vision; ANG - Field of vision ; ANGL - Field of vision left angle; ANGR - Field of vision right angle

Table 3 Forward regression for Positive Perfectionism

R= 0.59; R2= 0.34; SEE = 3.78	b	se	p
Intercept	50,35	3,78	0,0001*
ZBA/S2 - MEDDFK	0,05	0,02	0,0018*
ZBA/S2 - MEDTFK	-3,66	1,21	0,0056*
3D/S1 - WA	-0,43	0,25	0,0996
2HAND/S1 - EHC	0,12	0,09	0,1774*

R – correlation coefficient; R2 – R squared indicator; SEE – Standard Error of Estimation; b – model coefficient; se – standard error; p – statistical probability; MEDDFK - Median movement deviation on complex track; MEDTFK - Median time deviation on complex track; WA - Wrong answers; EHC - Eye-hand coordination

Table 4 Forward regression Negative Perfectionism

R= 0.48; R2= 0.23; SEE = 13.92	b	se	p
Intercept	1,85	25,03	0,9415
ZBA/S2 - MEDTFK	6,49	3,51	0,0751
2HAND/S1 - CDIF	10,90	5,67	0,0650
PP-R/S1 - ANGL	0,23	0,23	0,3124

R– correlation coefficient; R2– R squared indicator; SEE – Standard Error of Estimation; b– model coefficient; se– standard error; p– statistical probability; MEDTFK - Median time deviation on complex track; CDIF - Coordination impediment; ANGL - Field of vision left angle

Discussion

There are not much studies on cognitive ability in relation to dance. Especially when it comes to teenage expert dancers. Some characteristics of an individual dancer may contribute to the development of psycho-motor skills (Yazgan et al., 2017). Effectiveness of young dancers is determined by perception, processing verbal information and visual-motor respond (Korobeynikov et al., 2020a). But as the previous research showed on 11-12 years old elite female junior rhythmic gymnasts it is hard to identify the level of motor abilities (Zisi et al., 2009). Our research addresses the need for interest in this kind of abilities in this specific group.

Our research showed that negative perfectionism is statistically significant related to time and movement anticipation. It is a connection between motor-cognitive function resulting in brain condition (Ladda et al., 2020) and personality disposition (Flett and Hewitt, 2002). In our approach to perfectionism it is essential to look at dance as a sport, not as divided areas (Stoeber, 2014). It is valuable to remember that perfectionism can have different references depending on the co-occurring factors (Quested, 2014), as our results confirm. What should be emphasized that anticipation is important to synchronization and processing the choreographed routine in dancing (Ladda et al., 2020). As research showed on 11-12 years old elite female junior rhythmic gymnasts the level cognitive abilities rises because of more complex skills the person are able to do (Zisi et al., 2009). What is more in rhythm gymnastic dancing skills are related to ability of analyzing space and anticipation (Mullagildina, 2017).

Anticipation can be easier interpret by a gymnast because they are familiar with prediction motor movement connected to their position (Calmels et al., 2018). The longer an athlete spends in motor training, the better the anticipatory abilities turned out to be (Güldenpenning et al., 2012).

During the conducted test dancer had to make their own decision and press the button at the most accurate moment. High levels of perfectionism may play a role in a person's desire not to be wrong. To choose correctly there is a need to gain information, store it and process to correctly predict the consequences or implications (Raichle, 2010). Complicated choreography causes timing errors for dancers because they have to combine synchronization of movement with space and other dancers (Minvielle-Moncla et al., 2008).

Because of the level of expertise in action by ones motor experience it is possible to gain ability to predict what will happen (Amoruso et al., 2014). Especially in dancing, which requires making movement in limited space which the competition stage is (Schupp, 2020). Perfectionism in dancers may increase motivational regulations and one of them is a view on mistakes (Nordin-Bates and Kuylser, 2021), what might was exact appear when dancers took the test. As previous research showed there is a logical connection between self-regulation and achievement goals (Ntoumanis et al., 2014), that high level of perfectionism may influence on willingness to show excellence in their actions (Nordin-Bates and Kuylser, 2021). Dancers use anticipation time

and movement in combining way, because it is needed to move correctly on stage, which is connected in analyzing surroundings by background (Liu, 2021). That might be a reason why perfectionism is related to cognitive abilities, which our results showed. In the future research it is needed to analyze if high level of perfectionism unconsciously modify cognitive performance not only in specificdance abilities but also in daily-life.

The strength of our study is a link between one of a cognitive ability to anticipate to a personal trait. An observation that is valuable concerns that a personality trait like perfectionism, that is acquired through experiences and interactions with the environment, can subconsciously modify the cognitive response in specific situations. Dancing influence of self-perception and sensation of movement (Giguere, 2021). That is the reason why we assumed that perfectionism, which are opinion and expectation of doing something as good as possible consisted with strivings and concerns (Stoeber and Otto, 2006), will unconsciously modify the cognitive performance. Dancing requires to synchronise motor abilities with cognitive procedures (Korobeynikov et al., 2020b). There are some studies at perfection in dancing but there is a lack of examination this topic in connection to cognitive abilities in young dancers (Korobeynikov et al., 2020a). So the relationship between perfection and cognitive area is still not completely unexplored.

Our study has also practical implications.We believe that the topic is inexhaustible and the need for research especially on this age group. If we determine the level of skills it will be possible to design training to support the development using elements of dance. Dancing as a form of therapy supports the fostering of cognitive abilities at a good level (Sawami et al., 2019). It also can be interpreted as a protective factor for decreasing level of cognitive abilities caused by aging. The eldery former dancers had a higher result in cognitive and motor performance than non-dancers (Kattenstroth et al., 2010). The eldery expertise ballroom dancers have better sensorimotor and cognitive skills, especially in spatial orientation (Kattenstroth et al., 2011) and the hip-hop dancers have higher level of memory rotation (Bonny et al., 2017).

What is important these abilities are connected to anticipate the movement and consequences of movement. Since dance can protect cognitive skills, perhaps it can also predict better functioning and information processing from childhood. Because of the fact that dancing is the type of training which engages extensive prioproceptive and spatial abilities (Jola et al., 2011) we assumed that it helps with the development of cognitive processing. It is important to measure cognitive abilities not only in the context of sport but also in daily life achievements. As meta-analysis showed cognitive abilities as memory, reasoning or executive functions are this kinds of factors which can predict academic development (Peng and Kievit, 2020). Also longitudinal perspective confirmthat
(Peng et al., 2019). There is a need to conduct longitudinal studies to predict possible cognitive development which are support by dance. That is also a reason why we wanted to examine this specific cognitive functions in junior dancers.

Our study is not free from limitations. The examination of cognitive functions in dancers is challenging, because it is hard to reproduce identical test conditions as those encountered during a dance performance (Thompson et al., 2008). High level of perfectionism in dance is dangerous, especially for young females (Nordin-Bates and Kuylser, 2021). Not only negative but also positive perfectionism is linked to eating disorders (Nordin-Bates et al., 2016). And this factor in dancers may influence on cognitive flexibility in processing information (Estanol et al., 2013). It would be valuable to control this aspect in the future, especially that there is a relationship between perfectionism and a cognitive style (Hill et al., 2016). What more, in the future research will be valuable to examine perfectionism and time and movement anticipation in dancers including gender differences.

Conclusions

There are a few main conclusions of this paper. There are not much studies on cognitive abilities in relations to dance. In this study there were presented selected cognitive abilities in relation to personality trait like perfectionism in young junior female dancers, which is a valuable insight in this topic. This is a confirmation that abilities arising from the nervous system can be linked to those qualities that result from interaction with the environment.

Previous studies focused on the role of dance as a factor for supporting cognitive abilities in seniors. Our research showed that there is a space for diagnosing and projecting cognitive trainings in connection to this discipline in young children to support cognitive development not only in general but in alignment with sports. Anticipation of time and movement is one of the skills that a dancer uses on an ongoing basis during his performance.

Anticipation should be as effective as possible, and additional factors of the individual, like perfectionism, can modify it. If one incorporates this knowledge into the practical work of sports psychologists and coaches, more exercises can be designed for dancers to make more effective decisions in a limited space. Future studies should focus on that aspect in connection to specific dance routine and memory capacity.

Conflicts of interest - There is no conflicts of interest which should be declared.

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