Parents' Perceptions About the Correlation Between Motor Skills and Speech Development of their Children

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Abstract

Background: Children's development is a part of life that should be given great importance. Parents have different perceptions about motor, language and speech development, of their children. This research aimed to determine parents' perceptions regarding children's development in these areas.

Methods: Respondents of the research were 40 parents whose children had disorders in motor, language and speech development. The instrument used in this research was a questionnaire which has contained six demographic questions and 37 questions related to motor, speech and language development.

Results: There is a significant positive correlation between "Motor Development" with "Speech Development", r=.843**, p<0.01; between "Motor Development" and "Language Development", r=.791**, p<0.01. Motor development has an impact on speech development, which is also explained by the model, F (1/38) = 93.275, sig. =,000. T-test analysis shows that there are differences in the motor development of children, according to the village-city residence: t(38)= 3.148, p=.003.

Conclusions: There is a significant positive correlation between motor development and language-speech development; Motor development has an impact on children's speech development; Children who live in the countryside are more developed in terms of motor than children who live in the city.

Keywords: parents', perceptation, development, motor, language-speech

1. Introduction

Child development is a complex process, which mainly depends on the interaction of biological aspects with various environmental influences and experiences (Formiga & Linhares, 2015). Motor skills refer to the movement and coordination of an individual's muscles and body. These skills are usually divided into gross and fine motor skills. Gross motor skills require the

coordination of the arms, legs, and other large parts of an individual's body through which we perform actions such as running, jumping, and throwing (Haibach-Beach, Reid, & Collier, 2011). Meanwhile, fine motor skills require the coordination of movements of fingers or hands or feet, for various actions such as grasping small objects (Piek, Dawson, Smith, & Gasson, 2008).

Also, language is an individual's ability to communicate with others. Thus, it is worth noting that there are important differences between language comprehension and speaking. Language includes all forms of communication, whether spoken, written, signs used, gestures or facial expressions. While speech is a spoken language that is the most effective form of communication and is considered the most important and widely used (Indrayani, 2016).

Motor development and language development have historically been considered separately and viewed as independent domains from different theoretical perspectives (Gesell & Amatruda, 1945; Lennenberg, 1967). However, in recent decades, ecological and dynamic systems approaches to development (Gibson and Pick, 2000, Thelen and Smith, 1994) and the embodied cognition approach (Clark, 1997, Varela et al., 1991) have stimulated many researchers to study the co-development of motor and language skills, exploring the possibility of cross-domain interactions resulting in cascading changes during periods of developmental transition (Rothman et al., 2019).

During different years, starting from Greenfield (1991) then Thelen & Smith (1994) until Iverson (2010) it has been established that the various disorders that have to do with language and speech are also related to motor skills. So, a large number of studies have been done, which have shown that there is a common path between body action and language processing (Rizzolatti & Arbib, 1998; Fischer & Zwaan, 2008; Glenberg & Gallese, 2011).

Achievements in motor and language development by young children are an integral part of their overall development. The small body of literature on the relationship between language and action supports the embodied cognition theoretical perspective. This concept suggests that cognition and the cognitive processes involved in language production are influenced by the body's motor skills and interaction with the surrounding environment (Iverson & Braddock, 2011).

The connections between language and motor skills have started to be recognized much earlier. Iverson (2010) concludes that development paths within each domain are described in terms of rapid changes, plateaus, and wide variability, while Hill (1998) shows much earlier that common features have been found between domains.

Iverson & Braddock (2011) also immediately after the research done by Iverson (2010) come to the conclusion that, consequently, it is difficult to disentangle the associations. Most of the previous research on these associations has focused in a one-sided manner on the motor profiles of children with specific language impairment. Thus, Iverson (2010) and Alcock & Krawczyk (2010) emphasized in their two studies that a growing body of literature is investigating the connection between these developmental areas.

Gonzales et al., (2019) in their research point out that several different studies have been done with children, to measure the relationship between motor development and the child's speech. For example, these authors show that there are six cross-sectional studies that were conducted with infants and toddlers that measured the relationship between gross motor skills and language development using cross-sectional methods (Alcock and Krawczyk, 2010; Karasik et al., 2014; Walle and Campos, 2014; He et al., 2015; Houwen et al., 2016; Muluk et al., 2016). These studies have used different ways to identify if motor development affects language development. Overall, then, 50% of the studies in this section suggest that gross motor and language skills are simultaneously related in infancy, especially when gross motor skills are assessed by a single behavior (eg, walking) rather than a motor outcome gross (Walle & Campos, 2014; Libertus and Violi, 2016; Walle, 2016; West, 2018).

It is also worth noting that we also have nine longitudinal studies that were done on babies and toddlers, to measure the relationship between motor skills and language development (Lyytinen et al., 2001; Oudgenoeg-Paz et al., 2012, 2015, 2016; Walle and Campos, 2014; Libertus and Violi, 2016; Walle, 2016; West, 2018). Results from these studies showed that gross motor skills predicted language outcomes above and beyond age, concurrent motor skills, and parent-based social factors, such as joint parental engagement and viewing the infant as an individual (Libertus and Violi, 2016; Walle, 2016; West, 2018).

It is also worth to mention that we also have cross-sectional studies that were done with preschool and early childhood children (Wolff and Wolff, 1972; Rhemtulla and TuckerDrob, 2011; Cameron et al., 2012; Muluk et al., 2014). Even these studies have used different measures that result in a limited understanding of gross motor skills globally, but highlight possible differences between individual skills beyond crawling or walking that were common in infant studies and their correlates with language (Gonzales et al., 2019).

It can also be said that we have only one longitudinal study, which measures the development of gross motor skills and language, throughout the children's preschool age and early childhood (Wang et al., 2014). Based on this study, we understand that the results show that in this age range, gross motor skills continue to predict language outcomes, but not in a longitudinally stable manner as seen in infancy and childhood. Overall, this study shows that variations such as fine motor skills, basic language, and other individual differences potentially moderate gross motor relationships over time with language during preschool and early childhood (Gonzales et al., 2019).

2. Methods

2.1 The purpose and hypotheses of the research

The main purpose of this research was to determinate parents' perceptions about the connection between motor development and speech-language development.

1. There is a significant positive correlation between motor development and speech - language development.
2. Motor development has an impact on speech development.

3. There are differences between children's place of residence (rural-city) in motor development, language and speech.

2.2 Examines sample of the research

Respondents of the research were 40 parents whose children had disorders in motor development and language-speech development. Table 1 shows us that out of 40 parents, 9 of them or 22.5% were male and 31 of them or 77.5% were female.

Table 1. Gender of Respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	9	22.5	22.5	22.5
Female	31	77.5	77.5	100.0
Total	40	100.0	100.0	

Table 2 shows us that out of 40 parents who were respondents to the research, 5 of them or 12.5% lived in the village with their families and 35 of them or 87.5% lived in the city

Table 2. Place of Residence of the Respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
Rural	5	12.5	12.5	12.5
City	35	87.5	87.5	100.0
Total	40	100.0	100.0	

2.3 Research methods, techniques and instruments

The research approach of the paper is quantitative, where the data is obtained through surveys. If we talk about the type of research, it is of a pure research type, as it is being developed to explore an issue, and will be completed with the aim of gaining a better understanding of the general concepts. Also, based on the division of the time period, it is a cross-sectional or representative study, as it includes finding data from selected respondents due to their interest in the topic, at a certain point in time. The instrument used in this research was the questionnaire "Five-To-Fifteen-Revised (5-15R) (Kadesjö et al., 2017)" which was open for use. From this questionnaire, the adequate questions that were used for this research were separated, which were directly related to the motor development, speech and language of the children. This questionnaire contained six demographic questions and 37 questions related to motor development, speech and language. It is worth noting that the questions were of the closed type,

which belonged to the ordinal scale, with the answers - not applied, applied to some extent and applied. The responses of the respondents were analyzed with the Statistical Package of Social Sciences - SPSS/21, where frequency analysis, correlation analysis, T-test and regression analysis were used. So, the significance of these analyzes is observed up to $p<0.05$. The data of the respondents remain confidential and the participation was anonymous.

3. Results

3.1Correlation analysis

The results of the correlation analysis were obtained from the answers given to the parents in the questionnaire. As mentioned above, the questions have been divided into three groups. The first group included questions about motor development, the second group about speech and the third group included questions about language development. These questions are grouped by the option "Compute variable" which is presented in SPSS, grouping which was used to derive all the analyses. Based on the correlation analysis, there is a significant positive relationship between the variables presented in the table. Then, it can be said that there is a significant positive correlation between "Motor Development" and "Speech Development", r=.843**, p<0.01, at the same time there is a significant positive correlation between "Motor Development" and "Language Development", r=.791**, p<0.01. It is worth noting that there is a significant positive correlation between "Language Development" and "Speaking", r=.903**.

Table 3. Correlational analysis

		1	2	3
1. Motor	Pearson Correlation	1	.843**	
Development	Sig. (2-tailed)		.000	.000
	N	40	40	40
2. Speech	Pearson Correlation	.843**	1	.903**
Development	Sig. (2-tailed)	.000		.000
	N	40	40	40
3. Language	Pearson Correlation	.791**	.903**	1
Development	Sig. (2-tailed)	.000	.000	
	N	40	40	40

3.2 T-test analysis

According to the results of the analysis, the average of the 5 participating who live in the village is 36.8000, and the mean of the 35 others who live in the city is 24.6286. It is worth noting that there are differences in the motor development of children, according to village-city residence: t(38)= 3.148, p=.003.

According to the results of the analysis, the average of the 5 participating who live in the village is 32.4000, and the mean of the 35 others who live in the city is 22.4286. It is worth noting that there are no differences in the speech development of children, according to the village-city residence: t(38)= 2.125, p=.040.

According to the results of the analysis, the average of the 5 participating who live in the village is 8.4000 and, the mean of the 35 others who live in the city is 5.6000. It is worth noting that there are differences in children's language development, according to village-city residence: t(38)= 2.323, p=.026.

Table 4. Group Statistic

	Residence	N	Mean	Std. Deviation	Std. Error Mean
Motor Development	Rural	5	36.8000	13.16055	5.88558
	City	35	24.6286	7.26023	1.22720
Speech Development	Rural	5	32.4000	13.03073	5.82752
	City	35	22.4286	9.36604	1.58315
Language Development	Rural	5	8.4000	4.09878	1.83303
	City	35	5.6000	2.26482	.38282

Table 5. Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig.(2 - tailed)	Mean diference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Motor Development	Equal variances assumed	7,056	,011	3,148	38	,003	12,17143	3,86616	4.34480	19,99806
	Equal variances not assumed			2,024	4,354	,107	12,17143	6.01216	-3,99860	28,34146
Speech Developme	Equal variances assumed	1.464	.234	2.125	38	.040	9.97143	4.69315	,47064	19.47222
					4.609	.165	9.97143			

	Equal variances not assumed			1.651				6.03874	-5.95592	25.89878
Language Development	Equal variances assumed	7.138	.011	2.323	38	0.26	2.80000	1.20550	.35959	5.24041
	Equal variances not assumed			1.495	4.356	.203	2.80000	1.87258	-2.23593	7.83593

3.3 Regression analysis

Linear regression was used to test if motor development affects children's speech development. Thus, the results presented in table 6 show us that motor development has an impact on speech development, which is also explained by the model, F (1/38) = 93.275, sig. = ,000.

Table 6. Regression analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	F	Sig
1	.843[a]	.711	.703	5.58638	93.275	.000

a. Dependent Variable: Speech Development

b. Predictors: (Constant), Motor Development

4. Discussion

This research was built on the raised hypotheses through different analyses, for example for the first hypothesis we can say that there is a significant positive correlation between the variables presented in the table. Then, it can be said that we have a significant positive correlation between "Motor Development" and "Speech Development", r=.843**, p<0.01, at the same time there is a significant positive correlation between "Motor Development" and "Language Development", r=.791**, p<0.01.

For the second hypothesis, we can say that the results presented in table 6 show that motor development has an impact on speech development, which is also explained by the model, F (1/38) = 93.275, sig. = ,000.

As for the third hypothesis, the T-test analysis shows that there are differences in the motor development of children, according to the village-city residence: t(38)= 3.148, p=.003; there are no differences in the development of children's speech, according to village-city residence: t(38)= 2.125, p=.040; there are differences in children's language development, according to village-city residence: t(38)= 2.323, p=.026.

Based on the studies of different authors, we can also hypothesize our results, for which conclusions can be made later in the thesis, but in first view we can say that there will be differences in the development of fine and global motor skills. According to Wang et al., (2014) it is stated that: Neither gross nor fine early motor skills uniquely predicted later language performance. Motor skills were more stable in boys than in girls. Boys had lower scores than girls on fine motor performance, but gender differences in cross-lagged associations between language and motor performance were non-significant.

Two researches done in different countries such as America and China (Walle & Campos, 2014; He et al., 2015) have revealed that the development of walking in children aged 10-14 months is largely related to vocabulary developed. Then Acock & Krawczyk (2010) discovered that oral motor development is positively related to children's language skills. Oudgenoeg-Paz and co-authors (2012) found that children's independent sitting and independent walking directly predicted productive vocabulary skills in young children.

5. Conclusions

Based on the results of this research, we conclude that:

There is a significant positive correlation between motor development and speech, so the higher the motor development of the children, the higher is the development of their speech;

There is a significant positive correlation between motor development and language, the higher the motor development of children, the higher is the development of their language;

Motor development has an impact on children's speech development;

Children who live in the countryside are more developed in terms of motor than children who live in the city;

Also, both the children who exist in the village and those who live in the city achieve the development of speech and language to the same extent.

Refrences

[1]. Alcock, K. J., & Krawczyk, K. (2010). Individual differences in language development: relationship with motor skill at 21 months. Dev. Sci. 13, 677–691.

[2]. Cameron, C. E., Brock, L. L., Murrah, W. M., Bell, L. H., Worzalla, S. L., & Grissmer, D. (2012) Fine motor skills and executive function both contribute to kindergarten achievement. Child Dev. 83, 1229–1244.

[3]. Fischer, M. H., & Zwaan, R. A. (2008). Embodied language: A review of the role of the motor system in language comprehension. Quarterly Journal of Experimental Psychology, 61(6), 825–850. DOI:

[4]. Formiga, C.K.M.R., & Linhares, M.B.M. (2015). Motor Skills: Development in Infancy andEarly Childhood. In: James D. Wright (editor-in-chief), International Encyclopedia of theSocial & Behavioral Sciences, 2nd edition, Vol 15. Oxford: Elsevier, pp.971–977.

[5]. Gesell, A., & Amatruda, C.S. (1945). The Embryology of Behavior: The Beginnings of theHuman Mind. Harper & Brothers, New York

[6]. Gibson, E. J., & Pick, A. D. (2000). An ecological approach to perceptual learning and development. Oxford University Press.
[7]. Glenberg, A. M., & Gallese, V. (2012) Action-based language: A theory of language acquisition, comprehension, and production. Cortex, 48(7), 905–922.
[8]. Gonzales, L. S., Alvarez, V., & Nelson, L. E. (2019). Do gross and fine motor skills differentially contribute to language outcomes? A systematic review. Front in Psychology, 10:2670
[9]. Greenfield, P. M. (1991). Language, tools and brain: The ontogeny and phylogeny of hierarchically organized sequential behavior. Behavioral and Brain Sciences. 14:531–595.
[10]. Haibach, S. P., Reid, G., & Coller, H. D. (2011). Motor Learning and Development. Human Kinetics.
[11]. He, M., Walle, E. A., & Campos, J. J. (2015). A cross-national investigation ofthe relationship between infant walking and language development. Infancy, 20,283–305.
[12]. Hill, E. L. (2001). Non-specific nature of specific language impairment: a review of the literature with regard to concomitant motor impairments. Int J Lang Commun Disor;36(2):149-71
[13]. Hill, E. L. (1998). A dyspraxic deficit in specific language impairment and developmental coordination disorder? Evidence from hand and arm movements. Developmental Medicine and Child Neurology. 40 (6): 388-395.
[14]. Houwen, S., Visser, L., van der Putten, A., & Vlaskamp, C. (2016). The interrelationships between motor, cognitive, and language development in children with and without intellectual and developmental disabilities. Res. Dev. Disabil. 53, 19–31.
[15]. Indrayani, I. (2016). Language development at early childhood. International Conference on Education, Vol.1, July.
[16]. Iverson, J. M. (2010). Developing language in a developing body: the relationship between motor development and language development. Journal of Child Language. 37:229–61.
[17]. Iverson, J. M., & Braddock, B. A. (2011). Gesture and motor skill in relation to language in children with language impairment. Journal of Speech, Language, and Hearing Research, 54 (1)
[18]. Karasik, L. B., Tamis-Lemonda, C. S., & Adolph, K. E. (2014). Crawling and walking infants elicit different verbal responses from mothers. Dev. Sci. 3, 1–8.
[19]. Kadesjö, B., Janols. L-O, Korkman, M., Mickelsson, K., Strand, G., Trillingsgaard, A., Lambek, R., Øgrim, G., Bredesen, A. M., & Gillberg, C. (2017). Five-To-Fifteen-Revised (5-15R). Available at www.5-15.org
[20]. Lenneberg, E. H. (1967). Biological foundations of language. Wiley.
[21]. Libertus, K., & Violi, D. A. (2016). Sit to talk: relation between motor skills and language development in infancy. Front. Psychol. 7, 1–8.
[22]. Lyytinen, H., Ahonen, T., Eklund, K., Guttorm, T. K., Laakso, M. L., & Leppänen, P. H. T. (2001). Developmental pathways of children with and without familial risk for dyslexia during the first years of life. Dev. Neuropsychol. 20, 535–554.
[23]. Muluk, N. B., Bayoglu, B., & Anlar, B. (2014). Language development and affecting factors in 3- to 6-year-old children. Eur. Arch. Oto-Rhino-Laryngol. 271, 871–878.

[24]. Oudgenoeg-Paz, O., Leseman, P. P., & Volman, M. C. (2015). Exploration as a mediator of the relation between the attainment of motor milestones and the development of spatial cognition and spatial language. Dev. Psychol. 51, 1241–1253.
[25]. Oudgenoeg-Paz, O., Volman, M. C. J. M., & Leseman, P. P. M. (2012). Attainment of sitting and walking predicts development of productive vocabulary between ages 16 and 28 months. Infant Behav. Dev. 35, 733–736.
[26]. Oudgenoeg-Paz, O., Volman, M. J. M., & Leseman, P. P. M., (2016). First steps into language? Examining the specific longitudinal relations between walking, exploration and linguistic skills. Front. Psychol. 7, 1–12.
[27]. Piek, J., Dawson, L., Smith, M. L. & Gasson, N. (2008). The role of early fine and gross motor development on later motor and cognitive ability. Human Movement Science, 27(5): 668-81
[28]. Rhemtulla, M., & Tucker-Drob, E. M. (2011). Correlated longitudinal changes across linguistic, achievement, and psychomotor domains in early childhood: evidence for a global dimension of development. Dev. Sci. 14, 1245–1254.
[29]. Rizzolatti, G., & Arbib, M. A. (1998). Language within our grasp. Trends in Neurosciences, 21(5), 188–194.
[30]. Rothman, J., González Alonso, J., & Puig-Mayenco, E. (2019). Third language acquisition and linguistic transfer Cambridge University Press, Cambridge, UK.
[31]. Thelen, E. and Smith, L. B. 1994 A dynamic systems approach to the development of cognition and action. Cambridge, MA: MIT Press/Bradford.
[32]. Varela, F. J., Thompson, E., & Rosch, E. (1991). The Embodied Mind: Cognitive Science and Human Experience. MIT Press, Cambridge, MA.
[33]. Walle, E. A. (2016). Infant social development across the transition from crawling to walking. Front. Psychol. 7, 1–10
[34]. Walle, E. A., & Campos, J. J. (2014). Infant language development is relatedto the acquisition of walking. Dev. Psychol. 50, 336–348.
[35]. Wang, V. M., Lekhal, R., Aaro, E. L., & Schjolberg, S. (2014). The development relationship between language and motor performance from 3 to 5 years of age: a prospective longitudinal population study. BMC Psychol 2, 34 (2014).
[36]. West, K. L. (2018). Infant motor development in autism spectrum disorder: a synthesis and meta-analysis. Child Dev. 90, 2053–2070
[37]. Wolff, P., & Wolff, E. A. (1972). Correlational analysis of motor and verbal activity in young children. Child Dev. 43:1407.