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Manuela Valentini
University of Urbino Carlo Bo, Italy
https://orcid.org/0000-0003-2655-1778

Greta Vanni
University of Urbino Carlo Bo, Italy
https://orcid.org/0009-0004-7659-2150

Monica Minucci
University of Urbino Carlo Bo, Italy
https://orcid.org/0000-0003-4933-2762

EMBODIED COGNITION AND THE MONTESSORI APPROACH IN SECOND LANGUAGE ACQUISITION IN PRESCHOOL AGE CHILDREN: A SYSTEMATIC REVIEW*

Introduction: This paper examines how educational context, social relationships, and teaching methods influence preschool children's daily use of a second language.
Research Aim: The systematic review aims to confirm the theory that an experiential and motor approach is fundamental in second language acquisition.
Evidence-based Facts: After a thorough bibliographic search, fifteen articles were carefully analyzed that show how learning through bodily and multisensory experiences is beneficial for children.
Summary: The examined studies recognize the effectiveness of learning through multisensory bodily experience and movement. Among the various educational contexts, the Montessori learning environment is suitable for an early approach to second language acquisition.

Keywords: motor activity, pre-school education, motor development, second language learning, alternative pedagogy, language learning

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INTRODUCTION

This article considers the second language in children's everyday lives and the influences that the educational context, social relationships, and different methodologies have on it. Research highlights the cognitive and social benefits of early bilingualism (Ertanir et al., 2021). The target age group is preschoolers, for whom a linguistic approach focused on gestures and motor skills is highly effective (Valentini et al., 2018). The period from birth to six years is characterized by high neural plasticity, which facilitates natural acquisition of language when children are adequately exposed to it (Zeng et al., 2017). However, the effectiveness of this learning approach is strongly influenced and determined by stimuli in the educational context, the nature of social interactions, and the teaching methods used. In fact, traditional educational models that considered learning to be a purely cognitive process have given way to contemporary research that increasingly validates and supports the theory of embodied cognition, according to which cognitive processes are deeply rooted in the body's interactions with the world (Wilson & Golonka, 2013). This perspective is particularly significant for preschool children, whose main mode of learning is through sensory exploration and body movement. This aligns with fundamental theories of development. Piagetian theory emphasizes the role of sensorimotor intelligence in early development, arguing that children construct knowledge through movement (Piaget, 1950). Similarly, Vygotskian theoretical references highlight the importance of social interaction and cultural tools, which often involve physical engagement and gestures in early communication (Vygotsky, 1987).

Several studies have demonstrated a strong correlation between motor development and language skills (Andalò et al., 2022; Longobardi et al., 2014). Improved motor coordination and physical activity not only benefit health. They also improve attention, concentration and overall language performance (Valentini et al., 2018).

RESEARCH PROBLEM AND AIM

In the context of L2 learning, that is the acquisition of a second language, approaches that integrate gestures and physical movement, such as Total Physical Response (TPR) or dramatized storytelling, have shown high effectiveness in preschool settings (Coyle & Mora, 2018; Garcia et al., 2022). These methodologies use the connection between gesture and word, facilitating vocabulary acquisition and comprehension in a motivating and playful way. The Montessori learning environment is an example of this kind of experience. In fact, self-directed activity and a carefully prepared environment help children's body schema to manage itself in space and time and to relate to things, others, and the environment. Montessori (1948) considered the hand to be the "instrument of intelligence," emphasizing

the fundamental link between movement, sensory manipulation, and cognitive development. The Montessori environment can be particularly conducive to the natural acquisition of L2, as can the use of specific teaching materials designed to stimulate the senses and independent manipulation, linking motor activity to mental activity. Research suggests that this context enhances executive functions, reading, and vocabulary development (Gentaz & Richard, 2022; Lillard, 2012). By prioritizing sensory and motor experiences, the Montessori environment provides a suitable context for an early approach to L2, as children use language as a tool for communication and negotiation during practical tasks (Winnefeld, 2012).

Careful and thorough systematic review of the literature examines several studies that highlight the correlation between the development of motor coordination and language skills, the richness of childhood bilingualism and early exposure to foreign languages (Garcia et al., 2022). Analysis of the data collected leads to the recognition of the effectiveness of learning through multisensory bodily experience and movement (Longobardi et al., 2014). An "embodied," playful, and motivating approach is suitable for foreign language learning, especially during early childhood. Among the various educational contexts and thanks to the use of scientific materials that emphasize the validity of this pedagogy, the Montessori environment offers an early approach to the second language (Lillard, 2012).

The purpose of the various examined studies is to prove the fruitfulness of children's learning through multisensory bodily experience and movement (Andalò et al., 2022). This paper aims to reflect on the recognized benefits of early exposure to L2 and Embodied Cognition learning through a review of the literature, reasoning on the advantages of experiential approaches based on motor skills in second language acquisition among preschool children, with a particular focus on the Montessori learning environment. To guide this review, the following research questions (RQs) were formulated:

Q1: How does motor activity (including gross and fine motor skills and gestures) contribute to second language learning in preschool children?

Q2: Which Embodied Cognition methodologies (e.g., TPR, storytelling) are most effective for early second language acquisition?

Q3: How does the Montessori learning environment support motor development and second language acquisition in preschool children?

The benefits of this method can be seen at the motor, cognitive, and affective-relational levels, with a general impact on the healthy development of the individual. In particular, the "embodied" method, with playful and entertaining activities, acts as a stimulus for young children, activating and motivating learning and, in concrete terms, helping them to achieve abstraction. At this stage of development, the absorbent mind (Gentaz & Richard, 2022) allows children to acquire a second language naturally and effortlessly, achieving expressive abilities equal to those of a native speaker. Among the various educational contexts, the Montesso-

ri environment is well suited to offering an early approach to a second language (Winnefeld, 2012). Moving freely in space, children develop cognitive, emotional, and relational skills through movement, increasing their linguistic abilities not only in their mother tongue but also in one or more foreign languages (Ertanir et al., 2021).

METHODOLOGY

The review parameters were defined using the PICOC framework (Population, Intervention, Comparison, Outcomes, Context), which is suitable for systematic reviews in the social sciences, as shown in Table 1 below.

Table 1
PICOC Model

P	I	C	O	C
Population	Intervention	Comparison	Outcomes	Context
Preschool children (0-6 years)	Effects of motor programmes and Montessori pedagogy on early foreign language learning are analysed.	Programmes that include physical activities and Montessori materials in their approach to second language are compared with those that do not (e.g. traditional curriculum).	Analysis of effectiveness of children's learning through multisensory physical experience and Montessori approach (language, memory and motor results).	Educational context (e.g., kindergarten, preschool)

Note. Author's own elaboration.

This systematic review used open access scientific publications and did not involve people directly. Therefore, ethical approval from an Institutional Ethics Committee was not required. The review was conducted in accordance with standards of academic integrity, ensuring accurate reporting and citation of all sources. The bibliographic research was conducted between August 2022 and December 2023.

The choice and selection of articles included followed several steps, referring to the methodology of the PRISMA protocol (Preferred Reporting Items for Systematic reviews and Meta-Analyses, 2009) by More et al. (2009). The databases used were: OAIster, Directory of Open Access Journals, Gale Academic OneFile, ScienceDirect, ERIC, MLA, FRANCIS Archive, Science Citation Index Expanded, NRC Research Press.

The following keywords were entered into the databases to advance the search: Language development infancy, Motor development, Motor activity, Child development AND motivation, Pre-school education AND motor development, Second language learning AND preschool children, Alternative pedagogy AND language learning, Gesturing AND pretend play, English pronunciation, Cognitive development AND embodied. The keywords were selected to characterize the interdisciplinary nature of the research topic, which encompasses education, psychology, and cognitive sciences.

The selection process involved the following stages: screening of titles, abstracts, keywords and reading of full texts, as well as data collection, were carried out by the authors. Table 2 below summarizes the research methodology.

Table 2
Research methodology

Searching databases	Articles were searched for using keywords in selected databases.
Merging results and removing duplicates	Once studies had been collected, duplicates were removed.
Analysis of studies meeting inclusion criteria	Studies were reviewed and evaluated based on their adherence to inclusion criteria, eliminating those that did not meet them.
Inclusion of studies in review and their organisation	Studies meeting search criteria were included in review and organised according to: authors, article title, country, year, number of children, age, activity, duration of experiment, results, search engine.

Note. Author's own elaboration.

Following the selection of inclusion and exclusion parameters, shown in the table below, protocols consistent with the research objective were selected. Table 3 below summarizes inclusion and exclusion criteria

Table 3
Inclusion and exclusion criteria

PARAMETERS	INCLUSION CRITERIA	ECLUSION CRITERIA
Sample	Preschool children	School-age children and older
Interventions	Studies linking second language learning to gestures, motor activity, and educational learning environment	Studies that employ traditional approach to language learning
Comparison	Use of control groups or verification of actual effectiveness of intervention programme	Absence of control group or verification of actual effectiveness of intervention programme

Measurement and data collection	Studies involving questionnaires, interviews, tests and tools for assessing foreign language learning	Studies that do not involve data collection and measurements relating to effectiveness of intervention programmes
Type of studies	Full studies in English	Studies for which full text was not available and not in English
Timelines	Studies published between 2012 and 2023	Studies prior to 2012

Note. Author's own elaboration.

Bias risks: the subjects selected in the sample are not representative of the population due to the presence of factors that may influence the results. For example, the study participants know they are being observed and they could modify their behaviour; in addition, studies could be based on small number of samples. Assessment of the included studies reveals variability in methodological quality. Several articles report randomized controlled trials (e.g., Grøver et al., 2020; Zeng et al., 2017). However, others were based on relatively small samples (e.g., Gozel Tepe, 2020), which may be a limitation. There is significant potential for bias in studies evaluating the Montessori method (Gentaz & Richard, 2022; Lillard, 2012). Selection bias should be carefully considered, as families who choose Montessori education often belong to middle- to upper-class socioeconomic backgrounds. Furthermore, it is often difficult to verify the adherence of the Montessori method's implementation and to isolate the effects of the pedagogy from the influence of specific teachers. In some observational studies, the awareness of being observed may also influence participants' behaviour.

EVIDENCE-BASED FACTS

Fifteen studies were selected and the analysis was divided into: Studies highlighting the correlation between motor coordination development and language skills (6 studies): Andalò et al., (2022); Gozel Tepe (2020); Longobardi et al., (2014); Sánchez-González et al., (2022); Valentini et al., (2018); Zeng et al., (2017). Although these studies have often focused on global language learning (L1), they provide important data to support the theoretical framework of embodied cognition, which is the basis of L2 learning. These six studies highlight the correlation between the development of motor coordination and language skills and answer the research question: how much does motor activity affect language development and, in particular, the development of a second language learned at an early age? Studies highlighting the richness of bilingualism (2 studies): Ertanir, Kaiser-Kratzmann, and Sachse (2021); Garcia, Rosario, and Puga (2022). Studies on the benefits of an early approach to a second language through play, dramatised stories

and shared reading, T.P.R. method (4 studies): Coyle and Mora (2018); Fischer, Suggate, and Stoeger (2022); Grøver, Rydland, Gustafsson, and Snow (2020); Timmons et al. (2012). The two studies highlight the richness of bilingualism, while the next four concern early exposure to foreign languages and answer the following research questions: How early can children be exposed to a second language? Are the benefits greater at school age or can they be seen even earlier, starting from nursery school age or from nursery? Studies on the effectiveness of the Montessori environment and its pedagogy in early exposure to a second language (3 studies): Gentaz & Richard (2022); Lillard (2012); Winnefeld (2012). These three studies concern the effectiveness of the Montessori context and pedagogy in early second language acquisition and answer the research question: What is the appropriate learning context that promotes psychomotor development, considering it a fundamental factor in the development of cognitive functions in children?

The studies were published between 2012 and 2022 and were conducted in Europe (Italy, Germany, Spain, Norway, Switzerland, Turkey), North America (USA, Canada), and Asia (China). Methodologies varied, including randomized controlled trials, longitudinal studies, observational studies, and other systematic reviews. Sample sizes varied significantly, from small-scale studies (e.g., n = 36, Andalò et al., 2022) to large reviews (e.g., Timmons et al., 2012). The age range focused mainly on the pre-school years (0-6 years). However, one study (Winnefeld, 2012) considered primary school pupils (6-10 years): it was included nonetheless due to its specific relevance to the Montessori context and L2 learning (Q3).

The summary addresses the research questions by highlighting the interconnection between physical, cognitive, and linguistic development, supporting the theoretical framework of embodied cognition (Wilson & Golonka, 2013).

Evidence regarding Q1 indicates that motor activity has a significant impact on language development, both L1 and L2. The dynamic relationship between children's physical exploration and linguistic input (Andalò et al., 2022) emphasizes the importance of movement in early learning, aligning with Piaget on sensorimotor learning. For Q2, the review identified specific embodied methodologies, such as TPR and dramatized storytelling (Coyle & Mora, 2018), as highly effective. These methods utilize the connection between action and language (Garcia et al., 2022).

Addressing Q3, evidence suggests that the Montessori environment provides a favourable context for L2 learning. The intrinsic structure of the Montessori method, centred on sensory materials and autonomous activity, enhances executive functions, which are crucial for language learning (Gentaz & Richard, 2022; Lillard, 2012). Adaptability of the Montessori environment to interactive strategies such as Task-Based Language Learning (Winnefeld, 2012) further demonstrates its potential.

All of the examined articles show that motor activity has a positive impact on cognitive and linguistic development, with positive effects also found in second

language learning. In particular, exposure to a language other than the mother tongue is particularly recommended from birth and in a learning environment that combines gestures and words, verbal and analogical language.

Table 4 below summarizes the various examined articles, indicating the main bibliographical elements (authors, year, country, title) and information on analyzed research protocols.

Table 4
Results

Authors, year, country	Title	N° children	Age	Activity	Duration of experiment	Results	Database
Lillard, A. S., 2012, USA	*Preschool children's development in classic Montessori, supplemented Montessori, and conventional programs*	172, in 12 classes following classic, integrated and traditional Montessori programme	2-6 years	Faithful use of Montessori materials in section and classroom	6/7 months	Use of Montessori materials enhances executive functions, reading and vocabulary.	Science Direct
Timmons, B.W.; LeBlanc, A.G.; Carson,V.; Connor Gorber, S.; Dillman, C.; Janssen, I.; Kho, M.E.; Spence, J.C. Stearns, J.A.; Tremblay, M.S. 2012, Canada	*Systematic review of physical activity and health in the early years (aged 0–4 years)*	12,742 Divided into categories of infants, early childhood, and preschool age.	0-4 years	Exposure to physical activity, dancing, aerobics in early childhood	39 years	Exposure to physical activity, dancing, aerobics in early childhood	NRC

Winnefeld, J., 2012, Germany	*Task-based Language Learning in Bilingual Montessori Elementary Schools:Customizing Foreign Language Learning and Promoting L2 Speaking Skills*	Bilingual Montessori primary schools in Germany	6-10 years	Task-based activities in a bilingual Montessori context: find differences between two pictures, describe images to conversation partner.	Primary school cycle	Oral production in foreign language is encouraged by TBLL method, which creates opportunities for exchange and negotiation between interlocutors.	Directory of Open Access Journals
Longobardi, E.; Spataro, P.; Rossi, C., 2014, Italia	*The relationship between motor development, gestures and language production in the second year of life: A mediational analysis*	102, divided into 49 females and 53 males	12, 16, 20, 23 months	Administration of questionnaires to parents on their children's oral production at 4 stages: 12, 16, 20 and 23 months	12 months	Correlation between use of motor gestures, motor development, independent walking and oral production	FRANCIS Archive
Zeng, N.; Ayyub, M.; Sun, H.; Wen, X., 2017, USA,Cina	*Effects of Physical Activity on Motor Skills and Cognitive Development in Early Childhood: A Systematic Review*	15 randomised controlled trials	4-6 years	Exposure of children to physical activity programmes; control group following curriculum programme	12 months	Increased physical activity produces significant benefits in motor skills and cognitive development.	Science Citation Index Expanded

Coyle, Y. ; Mora, P. A. F. 2018, Spain	*Learning a Second Language in Pre-School: Using Dramatized Stories as a Teaching Resource*	Various nursery groups	2-3 years	Total Physical Response method, routine activities, dramatised stories	Pre--school cycle	Use of dramatised stories in preschool is excellent aid in approaching second language.	OAIster
Valentini, M.; Bernardini, C.; Beretta, A.; Raiola, G., 2018, Italia	*Movement and Language Development as an Early Childhood Twin Strategy: A Systematic Review*	4 studies on relationship between physical activity and language; 3 studies on relationship between language and academic performance	2-5 years	Fine motor skills, gross motor skills, physical activity programmes and physical activity	Analysis of publications 1999–2017	Physical activity has positive influence on language, attention and concentration in preschool children.	Directory of Open Access Journals
Gozel Tepe, Z.; 2020, Turkey	*Determining the Motor Ability Levels of the Preschool Children*	46 children, 22 girls, 24 boys	5-6 years	Kindergarten Mobile Test (KiMo) used to determine motor skill level	Single test or test repeated twice at 6-month intervals	Motor skills in city children are poorer than in rural children. This study supports physical activity as basis for healthy physical, mental and social development.	ERIC

Grøver, V.; Rydland, V.; Gustafsson, J.; Snow, C., 2020, Norway	*Shared Book Reading in Preschool Supports Bilingual Children's Second-Language Learning: A Cluster-Randomized Trial*	464 children divided into 123 nursery sections, in 60 nurseries in Oslo	3-5 years	Foreign language reading programme at school and at home, unlike control group	1 school year	Effectiveness of shared reading in foreign language and discussion activities related to readings to promote second language development	MLA
Ertanir, B.; Kaiser-Kratzmann, J.; Sachse, S., 2021, Germany	*Long-term interrelations between socio-emotional and language competencies among preschool dual language learners in Germany*	216 children from 19 nursery schools	3-6 years	Questionnaires for families; BIKO scale used by teachers to assess children's behaviour.	1 year	Correlation between lexical and emotional skills; children with high relational skills demonstrated higher linguistic skills in foreign language.	MLA

Andalò, B.; Rigo, F.; Rossi, G.; Majorano, M.; Lavelli,M.; 2022, Italia	*Do motor skills impact on language development between 18 and 30 months of age?*	36 children	From 18 to 30 months	Using Griffiths Mental Development Scales, gross motor skills and fine motor skills are observed.	Three 25-minute sessions repeated twice per year, six months apart	Motor coordination skills promote language acquisition between ages 2 and 3; motor and language development are dynamically related.	Science-Direct
Gentaz, E.; Richard, S., 2022, Switzerland	*The Behavioral Effects of Montessori Pedagogy on Children's Psychological Development and School Learning*	Groups of children participating in three randomised controlled trials	3-4-5 years	Application of Montessori pedagogy and use of specific materials	3 years	Experiment 1: greater cognitive flexibility and creativity. Experiment 2: improved academic performance. Experiment 3: positive effects on letter recognition.	Directory of Open Access Journals

Fischer, U.; Suggate, S.P.; Stoeger, H., 2022, Germany	*Fine motor skills and finger gnosia contribute to preschool children's numerical competencies*	153 children, 74 girls, 79 boys	Preschool age 3-6 years	Checking dexterity, agility and finger perception 4 numerical tasks: counting and showing count with fingers, representing count and number line	30-minute tests carried out in two sessions	Counting and representing numbers with fingers contributes to early development of numerical calculation.	Science-Direct
Garcia, R.; Rosario, P.; Puga, E.,2022, Spain	*Effectiveness of a Motor Intervention Program on Motivation and Learning of English Vocabulary in Preschoolers: A Pilot Study*	88 children from 3 childcare centres	4-7 years	Motor intervention programme on sample, compared to control group	5 weeks	Activities based on gestures and motor skills have positive effect on vocabulary enrichment in second language.	Directory of Open Access Journals
Sánchez--González, M.C.; Palomo--Carrión, R.; De-Hita- Cantalejo, C.; Romero--Galisteo, R.P.; 2022, Spain	*Visual system and motor development in children: a systematic review*	23 articles examining 3,980 children	From 2 to 18 years old	Revisione sistematica secondo le linee guida Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)	Systematic review from 2005 to 2021	All studies confirm relationship between healthy visual system and proper development of motor skills.	Gale Academic OneFile

Note. Author's own elaboration.

SUMMARY

Overview of the analyzed studies confirms the importance of motor development as a basis for cognitive development and proves richness of bilingualism in childhood. An early approach to foreign languages through play and a motivating learning environment not only promotes linguistic development but also has a positive impact on executive functions and interpersonal skills. All examined articles highlight how motor activity has a positive impact on children's cognitive and linguistic development, with positive effects also found in second language learning. In particular, exposure to a language other than the mother tongue is particularly recommended from birth and in a learning environment that combines gestures and words, verbal, and analogical language. The various studies considered and the subsequent review highlight how, thanks to movement and motor activity, children can achieve cognitive, linguistic, and emotional-relational learning (Valentini et al., 2018).

CONCLUSIONS

Language development occurs during a period when the mind is particularly receptive, meaning that children are able to develop not only their mother tongue but also a second language with extreme ease if they are exposed to it between birth and early childhood (Grøver et al., 2020). Contrary to what was previously believed, this results in excellent language comprehension and production, equal to that of a native speaker. This does not mean that a second language cannot be learned at a later age, but it will no longer be a spontaneous acquisition that occurs naturally and effortlessly. Considering, therefore, that early childhood is the most suitable period for exposure to a second language, effective methodologies start from an "embodied" perspective (i.e., children filter words and concepts through the embodied, sensory, and bodily experience), in order to make children protagonists and builders of their own knowledge. One learning environment examined in this analysis and found to be particularly effective for early second language learning is the Montessori environment, as specific work materials and teaching methods place the child at the centre of the educational process using a methodology that combines gestures with words, sounds with images, and manipulation with concepts (Winnefeld, 2012).

This systematic review summarized the evidence that demonstrates a strong link between physical activity and language development in preschool children, supporting the principles of embodied cognition. The results confirm the effectiveness of methodologies that prioritize sensory and bodily experience. The Montessori environment, with its focus on movement, manipulation, and child autonomy, is a particularly helpful context for L2 learning. Despite the limited amount

of specific literature available, the results strongly support work on embodied cognition and playful, motivating environments for foreign language teaching in early childhood education.

Efforts should focus on addressing identified gaps. More rigorous, large-scale longitudinal studies are certainly needed to track L2 development in different pedagogical contexts. Experimental validation studies are useful in comparing embodied cognition with traditional approaches. Further research is also important to investigate L2 learning in Montessori preschool contexts, verifying socio-economic factors and ensuring high fidelity of implementation.

LIMITATIONS

The limitations of the studies are identified as follows: better results achieved by children in Montessori classes possibly due to greater sensitivity on the part of parents and teachers ore due to the medium-high social status of the families to which they belong (Lillard, 2012). Furthermore, we have lack of control over the faithful application of the Montessori method and the specific use of materials by teachers (Gentaz & Richard, 2022). In addition, the figure of the Montessori teacher, a discreet and sensitive observer, can influence the behavior of the learner (Lillard, 2012). At least, there was examined low sample size (Gozel Tepe, 2020; Zeng et al., 2017).

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EMBODIED COGNITION I PODEJŚCIE MONTESSORI W NAUCE DRUGIEGO JĘZYKA W WIEKU PRZEDSZKOLNYM: SYSTEMATYCZNY PRZEGLĄD

Wprowadzenie: Niniejszy artykuł skupia się na roli drugiego języka w codziennym życiu dzieci w wieku przedszkolnym oraz na wpływie, jaki wywierają na niego kontekst edukacyjny, relacje społeczne i różne metody nauczania.
Cel badań: Systematyczny przegląd ma na celu potwierdzenie teorii, zgodnie z którą podejście oparte na doświadczeniu i motoryce ma fundamentalne znaczenie w przyswajaniu drugiego języka.
Stan wiedzy: Po dokładnym przeszukaniu literatury przedmiotu przeanalizowano piętnaście artykułów, które pokazują, jak korzystne dla dzieci jest uczenie się poprzez doświadczenia fizyczne i wielozmysłowe.
Podsumowanie: Badania potwierdzają skuteczność uczenia się poprzez wielozmysłowe doświadczenia cielesne i ruch. Spośród różnych kontekstów edukacyjnych środowisko edukacyjne Montessori nadaje się do wczesnego podejścia do przyswajania drugiego języka.

Słowa kluczowe: aktywność ruchowa, edukacja przedszkolna, rozwój motoryczny, nauka drugiego języka, pedagogika alternatywna, nauka języków