

## SELECTED ASPECTS OF SPECIAL EDUCATION IN POLAND FOR SUSTAINABLE REGIONAL DEVELOPMENT – STATISTICAL ANALYSIS

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**Purpose:** The main purpose of the paper is to draw attention to the need of implementing one of the factors of equitable development, that is to remove barriers of social exclusion faced by people with disabilities and provide them with access to high standard education.

**Design/methodology/approach:** The study used quantitative statistical methods (cointegration, dynamics measures, linear dependence) to determine changes and dependencies in the population, and in the education system in Poland.

**Findings:** The results of the study showed that the convergent dynamics of change (population) cannot be confirmed by a long-term interrelation. However, the year-by-year increasing number of institutions confirms the high dependence on special institutions in the regions, indicating two most advanced regions in special education in Poland.

**Research limitations/implications:** The research conducted in the article was based on general data on the number of children and facilities providing education with special educational needs. Further exploration is required to learn about the special needs of students resulting from their degree of disability in particular areas of the country, in order to direct regional development towards fully equitable development.

**Practical implications:** Recognising the local educational needs of children, especially those requiring greater personal educational involvement, is a source of knowledge for entrepreneurs. In a region of increased activity by people with disabilities, there is a greater demand for investments aimed at improving the qualifications of special education experts and entrepreneurs providing specialized equipment for learning and rehabilitation. Such activities have a real impact on improving the economic situation of the region.

**Originality/value:** The paper refers to the increased government involvement in the field of inclusive education and general trends in adapting or creating places "friendly to people with disabilities".

**Keywords:** education, disability, equitable development, region.

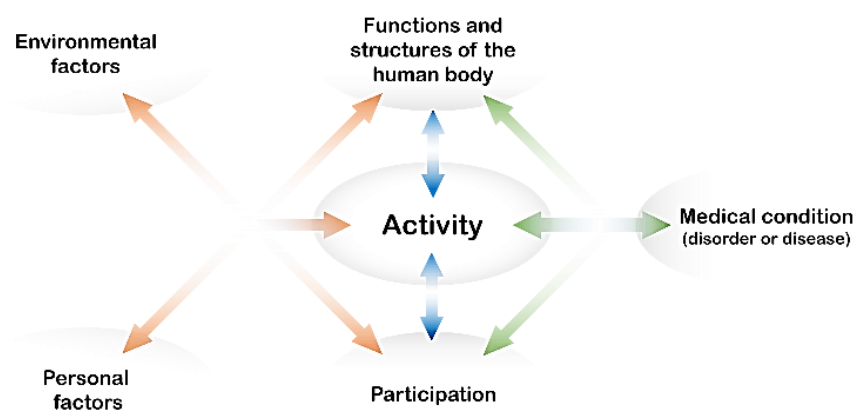
**Category of the paper:** Research paper.

## 1. Introduction

Sustainable development assumes balance in broadly understood consumption, taking into account the environment, climate and nature surrounding us. The general idea is to take care of the Earth's resources in such a way that there will be enough for everyone, in particular for future generations (UN, 1987; Kamble et al., 2018; Ren et al., 2022). Therefore, it is important that education in this field be complete, and that the development aspect begins at the regional level. The goal of sustainability concept in education is to support learning culture that values diversity and creativity. Such education should also enable students themselves to participate in sustainable development (Sterling, Orr, 2001). Thanks to this approach education can be described as sustainable. This issue is defined by Lin and co-authors (Lin et al., 2023). They describe sustainable education as a learning process that emphasizes personalization and student centeredness in a way to develop the skills needed by this social group. The modern technology, which accompanies the young generation on daily basis is a determinant in the approach to achieving sustainable education. Incorporation of modern information technologies, such as intelligent teaching systems (ITS) (Carbonell, 1970) and technology-enhanced learning (TEL) (Deng, Benckendorf, 2020) are the starting point for achieving high-quality education. Irina Bokova, Director-General, UNESCO: "The benefits of education permeate all walks of life right from the moment of birth. If we are to eradicate poverty and hunger, improve health, protect our planet and build more inclusive, resilient and peaceful societies, then every individual must be empowered with access to quality lifelong learning, with special attention to opportunities for girls and women. The evidence is unequivocal: education saves lives and transforms lives; it is the bedrock of sustainability. This is why we must work together across all development areas to make it a universal right" (UNESCO, 2023).

Building a sustainable future depends on education, which is one of the key areas of the 17 global goals, the so-called Sustainable Development Goals (SDG). The 2030 Agenda for Sustainable Development is a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity. The basic assumption of the goals with their 169 associated targets is to observe human rights, including equal treatment of all social groups regardless of their views. The Agenda therefore undertakes not to leave anyone out, including people with disabilities (or other socially disadvantaged groups). It recognizes disability as a cross-cutting issue which must be taken into account in achieving all SDGs (UN, 2015). There are areas such as standard of living, appropriately paid work, participation in education or also in social life, in which disabled people constitute a particularly socially privileged group. The 2030 Agenda can be a guide for countries and local communities to help achieve development in disability integration. According to the provision in the preamble of the Convention on the Rights of Persons with Disabilities (CRPD, 2007), disability is an evolving concept, and defines persons with disabilities as those who have 'long-term

physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others. In 1980, the World Health Organization (WHO) published the International Classification of Impairments, Disabilities and Handicaps (ICIDH, abbreviated as ICF - International Classification of Functioning), which, after five years of detailed research and international consultations, was approved for international use by the fifty-fourth WHO Assembly on 22 May 2001 (resolution WHA54. 21). Classification is a description of a process that provides the means to create maps of various structures and fields. The importance of the interrelations between individual components is presented in Figure 1.



**Figure 1.** Interrelations between ICF components.

Source: Own work based on (WHO, 2001).

This interactive and evolutionary process constitutes a multidimensional approach to the classification of functioning and disabilities. It provides “building blocks” for users who want to explore various aspects of this process or create models (WHO, 2001).

The issue of disability covered by the SDG goals is to be resolved by achieving the following targets (UN, 2015):

- SDG 4.5: eliminate gender disparities in education, ensure equal access to all levels of education and vocational training for the most vulnerable group, including people with disabilities, indigenous peoples, and children in vulnerable situations.
- SDG 4.A: create new and improve existing education facilities that are child (boys and girls), disability and provide safe, non-violent, inclusive and effective learning environments for all.
- SDG 8.5: ensure full and productive employment and decent work for all women and men, including for young people and persons with disabilities, equal pay for work of equal value.
- SDG 8.6: substantially reduce the proportion of youth not in employment, or not participating in education and training.

- SDG 10.2: empower and promote the social, economic and political inclusion of all, regardless of age, gender, disability, race, ethnicity, nationality, religion or economic or other status.
- SDG 11.2: provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, especially by developing public transport. Particular attention should be paid to the needs of vulnerable situations, women, children, persons with disabilities and older people.
- SDG 11.7: provide easy and universal access to safe, inclusive and accessible, green and public spaces, especially for women and children, older people and persons with disabilities.

People with disabilities are the largest minority group in the world. They are much more likely to become the victims of violence than other people. According to data published by the UN Information Centre in Warsaw: a) incidences of violence occur almost 4 times more often against children with disabilities and 1.5 times more often against adults compared to able-bodied coevals; b) adults with mental illnesses are almost 4 times more at risk of being the victims violence; c) stigmatization, discrimination and ignorance as well as the lack of support for their caregivers increases the risk of violence against people with disabilities; d) one in seven persons worldwide has a disability, hundred million of them are children; e) 80% of people with disabilities live in developing countries, and 50% of them cannot afford health care (UNIC WARSAW, 2017).

## 2. Literature review

Special education was for the first time described in Public Law 94-142, 94th Congress, Education for All Handicapped Children Act of 1975: “SEC. 4. (a) Section 602 of the Act (20 U.S.C. 1402) is amended— (...) (4) by adding at the end thereof the following new paragraphs: “(16)The term 'special education' means specially designed instruction, at no cost to parents or guardians, to meet the unique needs of a handicapped child, including classroom instruction, instruction in physical education, home instruction, and instruction in hospitals and institutions.” (...) “(18) The term 'free appropriate public education' means special education and related services which (A) have been provided at public expense, under public supervision and direction, and without charge, (B) meet the standards of the State educational agency, (C) include an appropriate preschool, elementary, or secondary school education in the State involved, and (D) are provided in conformity with the individualized education program required under section 614(a)” (Public Law 94-142, 1975).

In Poland, the right to education is guaranteed by the Constitution of the Republic of Poland, ascertained by Article 70, which states, among others, that education to 18 years of age shall be compulsory and free of charge in public institutions and that public authorities have the obligation to ensure universal and equal access to education, along with maintaining the autonomy of higher education institutions on the principles set out therein (Constitution of the Republic of Poland, 1997). The right to education in Poland is also assured in the Education Law Act of December 14, 2016, which upholds the principles contained in the Constitution of the Republic of Poland, the Universal Declaration of Human Rights, the International Covenant on Civil and Political Rights and the Convention on the Rights of the Child. Article 2 of this Act describes the components of the education system, including schools and special departments as well as counselling centres and institutions. In turn Article 4 sections 2 and 3 define correspondingly a special unit as the one intended for pupils/students with a certificate of need for special education, referring to Article 127 describing this form of education: “Special education covers children and adolescents with disabilities, socially maladjusted and at risk of social exclusion, requiring special organization of learning and work methods”. Sections 3 and 4 of this article describe correspondingly the individual educational and therapeutic programme and the organization of education and upbringing meeting the needs of special education, (Journal of Law 2023, items 900, 1672 and 1718).

The phrase “people with special needs” has an inclusive nature since it refers to people with behavioural, cognitive, sensory, academic and social problems, as well as gifted people (Küçükalkan et al., 2023). Rodriguez and Garro-Gil (2015) distinguish four main stages of the development of special education:

- Exclusion – pertained to people with disabilities or special needs who were eliminated from all social contexts such as family, school, community.
- Segregation – segregated education took place in special schools and classrooms. Its purpose was to relieve public schools of the burden of educating students who were unable to meet the curriculum requirements, thus hampered teaching and educational work. At this stage, learning difficulties were attributed to intellectual impairment of an individual student. Special schools and classes were to provide conditions that mainstream schools could not ensure. The advantages of segregated education are smaller class sizes, specialized education of staff and a much better position of such a child in informal structures of coevals (Serafin, 2009).
- Integration – at this stage public schools were obliged to create a new space for students with special needs, so that they could meet other students without any mental impairments. This space included regular classrooms, special education classrooms, and additional services (Franklin, 1996). The concept and practice of integration assumed that the conditions of education in a mainstream school could be transformed in a way that would create teaching-learning space suitable also for children with disabilities (Sochacka, 2012).

- Inclusion – from the very beginning, social structures and educational facilities such as classrooms, schools, communities and socio-educational activities are designed with students with special needs in mind (Rodriguez, Garro-Gil, 2015). The idea of inclusive education is holistic, focusing on the entire class of pupils/students, enabling effective learning for all children in the classroom. In the education process, the student adapts to the curriculum requirements and the pace of teaching, while the teacher adapts the organization of learning, teaching methods and the given student's needs. This solution enables students to cope and achieve success to the best of their abilities (Szumski, 2006).

Birkan (2002) draws attention to the situation when families learn that their children have an increased risk of abnormal development, most often at their age of 0-6. In such a difficult situation for the family, an early education programme can help. Its aim is to develop healthy patterns of interaction between children with disabilities and other members of the family. It consists of providing parents with information about children's traits, communication methods and their basic needs, which enable the family to make best possible progress and changes in the child's development. Ysseldyke, Algozzine and Thurlow, (2000), point out the lack of sufficient research on children with disabilities aged 0-3. It is important to provide children with special education from their earliest age. This will make it possible for them to establish social contacts like normally developing children, which will help them to determine their place in society. Research on this age group was conducted by researchers from Turkey who compared special education for young pupils in four countries: Turkey, Hungary, Italy and Romania. The overall results showed that these countries have an inclusive education system. Hungary additionally uses integrated education, while Turkey uses an individualized curriculum (Demirok, Haksiz, 2015). Casale, Golann, LeMaster, (2021), provided interesting information about special education. They checked the level of legal knowledge of school principals and deputy principals in the United States regarding special education. In the United States, the Individuals with Disabilities Education Act (IDEA) sets out many detailed policies and procedures that, if not understood and followed, can result in strained relationships with families and an inability to resolve educational problems. The results indicate a rather average level of knowledge of school management staff, as principals answered approximately 60% of the questions regarding the law on special education.

In 2009, in Poland, the Team for Special Educational Needs, established by the Ministry of National Education (MEN, 2010), began its activities which purpose was to indicate the direction of changes in the field of inclusive education. The work was continued by the Team for developing a model for educating students with special educational needs established in 2017 by the Minister of National Education (MEN, 2017). After public consultations, the model set down the most important direction of changes. At a conference under the heading "Planned changes based on the education for all model" (21 October 2021), the developed legal and financial solutions, based on the education for all model, were discussed (MEiN, 2021).

The direction of change in the education of pupils with special educational needs refers, first of all, to the implementation of solutions for inter-ministerial and comprehensive support provided under the National Support System for children, pupils and families, which covers communes, counties, all the way up to the level of ministries. The second aspect of changes is the introduction of a new model of support for child development and family support (WWR), covering children from their birth to the primary school. Another change focuses on how to assess the needs of children and pupils and how to plan, provide and evaluate the effectiveness of the support provided. The implementation of a biopsychosocial approach and the use of the International Classification of Functioning, Disability and Health (ICF) will make it possible to use functional assessment. The last changes are about the implementation of the pilot model of Specialized Centres Supporting Inclusive Education (SCWEW), which is intended to regulate schools and special institutions capacities to play a new role and undertake tasks in supporting kindergartens as well as mainstream and integrated schools. The changes also concern teachers, namely the standards for employing specialists in kindergartens and mainstream schools, including integrated schools and those with integration divisions as well as enlarging current possibilities for improvement along with the professional development of teachers and supervision specialists. (Jachimczak, Podgórska-Jachnik, 2023).

### 3. Statistical material and method

The goal of the research process was to determine the interrelation the relationship between the variables defined as:

- Number of children/adolescents of the specified age:
  - A<sub>1</sub>: 3-6 years old.
  - A<sub>2</sub>: 6 years old.
  - A<sub>3</sub>: 7-14 years old.
  - A<sub>4</sub>: 15-19 years old.
  - A<sub>5</sub>: 15-20 years old.
- Number of children/adolescents with special educational needs in specified facilities:
  - B<sub>1</sub>: number of children with disabilities in nursery schools.
  - J<sub>2</sub>: number of children with disabilities in the pre-primary sections in primary schools.
  - D<sub>3</sub>: number of children in special primary schools.
  - F<sub>4</sub>: number of adolescents in special general secondary schools.
  - G<sub>5</sub>: number of adolescents in special stage I and II sectoral vocational schools and in special basic vocational schools.
  - H<sub>5</sub>: number of adolescents in special technical schools and in special specialised general secondary schools.

- Number of facilities educating children/adolescents with special educational needs – overall:
  - I<sub>B1</sub>: number of nursery schools teaching children with disabilities.
  - II<sub>J2</sub>: number of pre-primary sections in primary schools teaching children with disabilities.
  - III<sub>D3</sub>: number of special primary schools.
  - IV<sub>F4</sub>: number of special general secondary schools.
  - V<sub>G5</sub>: number of special stage I and II sectoral vocational schools and special basic vocational schools.
  - VI<sub>H5</sub>: number of special technical schools and special specialised general secondary schools.
- Number of facilities educating children/adolescents with special educational needs – in individual voivodeship and overall in Poland.
  - PL: Poland.
  - PL<sub>DŚ</sub>: Dolnośląskie Voivodship:
    - PL<sub>DŚ(B)</sub>: number of special nursery schools.
    - PL<sub>DŚ(J)</sub>: number of special pre-primary sections in primary schools.
    - PL<sub>DŚ(D)</sub>: number of special primary schools.
    - PL<sub>DŚ(F)</sub>: number of special general secondary schools.
    - PL<sub>DŚ(G)</sub>: number of special stage I and II sectoral vocational schools, special basic vocational schools and special job-training schools.
    - PL<sub>DŚ(H)</sub>: number of special technical schools and special specialised general secondary schools.
  - PL<sub>KP</sub>: Kujawsko-Pomorskie Voivodship<sup>1</sup>.
  - PL<sub>LB</sub>: Lubelskie Voivodship.
  - PL<sub>LS</sub>: Lubuskie Voivodship.
  - PL<sub>LD</sub>: Łódzkie Voivodship.
  - PL<sub>MP</sub>: Małopolskie Voivodship.
  - PL<sub>MZ</sub>: Mazowieckie Voivodship.
  - PL<sub>OP</sub>: Opolskie Voivodship.
  - PL<sub>PK</sub>: Podkarpackie Voivodship.
  - PL<sub>PD</sub>: Podlaskie Voivodship.
  - PL<sub>PM</sub>: Pomorskie Voivodship.
  - PL<sub>ŚL</sub>: Śląskie Voivodship.
  - PL<sub>ŚK</sub>: Świętokrzyskie Voivodship.
  - PL<sub>WM</sub>: Warmińsko-Mazurskie Voivodship.
  - PL<sub>WP</sub>: Wielkopolskie Voivodship.
  - PL<sub>ZP</sub>: Zachodniopomorskie Voivodship.

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<sup>1</sup> the number of special facilities for each voivodship, similarly to the number of special facilities in the Dolnośląskie Voivodship.



In the quantitative study the tools used were the ones applied for time series analysis. Time series cointegration was used to determine the dependence and nature of the long-term interrelation between variables characterizing the population; index methods to determine the pace and intensity of changes in all studied variables and the study of correlation determining the strength of interrelations between variables divided by voivodeships.

Data for the analysis were obtained from Statistics Poland, using the Local Data Bank tool and an annual publication from the series: Information and studies, studies on education and upbringing for a given school year (Polish: Informacje i opracowania, opracowania na temat oświaty i wychowania dla danego roku szkolnego). Due to the diverse data collection process, the respective years were 2000-2021 (population, facilities); 2010-2021 (facilities by voivodeships). The subject of the study is the territory of Poland in general and in particular voivodeships.

### 3.1. Cointegration of time series

According to Welfle (2003), the state of long-term equilibrium, is the state to which the system tends after being thrown out of balance. It will be achieved after a finite time has elapsed, provided that it is not subjected to the action of external forces.

$$Y_t = \alpha_0 + \alpha_1 X_t + \varepsilon_t \quad (1)$$

The basic feature of apparent regression (Strahl et al., 2004) is the unrelatedness of non-stationary variables as to cause and effect, which may create the apparent statistically significant interrelation when a model is constructed on their basis. The phenomenon of apparent regression is a factor conditioning the occurrence of an interrelation between the value of empirical statistics (autocorrelation test using the Durbin-Watson statistics) and the determination coefficient, called the “rule of thumb”.

$$DW < R^2 \quad (2)$$

Unit root test – The Dickey-Fuller test <sup>2</sup>, for a unit root checks the stationarity of a time series, i.e. the degree of its integration. D.A. Dickey and W. Fuller’s (Kosicka et al., 2015) null hypothesis test assumes that in the autoregressive equation the parameter is zero.

$$Y_t = \beta_1 Y_{t-1} + \varepsilon_t \quad (3)$$

The intercept is used when the estimates of structural parameters in the models differ significantly.

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \varepsilon_t \quad (4)$$

An integrated series of d degree is defined by Cheremz and Deadman (1997) as a non-stationary series, made stationary by calculating its increments d times. The stationarity of the Y<sub>t</sub> variable means that it is integrated to zero degree, while a series whose first (or higher) increments are constant, i.e. integrated to first (or higher) degree, is a non-stationary series.

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<sup>2</sup> In the case of models with autocorrelation of the random component, the ADF test (extended Dickey-Fuller test) should be used.

$$Y_t \sim I(d) \quad Y_t \sim I(0) \quad Y_t \sim I(1) \quad Y_t \sim I(2) \dots \quad (5)$$

Cointegration testing should be done for at least two variables that indicate the existence of a long-term interrelation. According to Engle and Granger (1987) time series of two variables are cointegrated of  $d, b$  degree ( $d \geq b > 0$ ), when both series are integrated of  $d$  ( $Y_t, X_t \sim I(d)$ ) degree and there is a linear combination of these variables integrated of  $d-b$ .

$$Y_t, X_t \sim CI(d, b) \quad (6)$$

Error correction models (ECM) for cointegrated time series apply to models for variable increments. They are supplemented with the so-called an adjustment component that expresses the long-term equilibrium (interdependence) between non-stationary variables. The form of models for which ECM is a vector of residuals of the long-term equilibrium model (Strahl et al., 2004).

$$\Delta Y_t = \gamma_0 + \gamma_1 \Delta X_t + \gamma_2 ECM_{t-1} + \eta_t \quad (7)$$

or 
$$\Delta Y_t = \gamma_0 + \gamma_1 \Delta X_t + \gamma_2 (Y_{t-1} - \alpha_0 - \alpha_1 X_{t-1}) + \eta_t \quad (8)$$

### 3.2. Indexes

The direction and intensity of changes that take place in the studied phenomenon over a specific time are described by dynamics measures (Nowak, 2001). Two types of measures: on a fixed base (single-base) and mobile (chain based), characterize the level of the period that was adopted as the base.

Single-base dynamics measures assess the level of changes in the phenomenon that occurred in subsequent periods ( $x_t$ ), compared to the designated period, while chain dynamics measures assess changes in the level of the phenomenon which take place in the subsequent analysed periods ( $x_{t-1}$ ). The dual characteristics of the measures informs about increments (a, b) and indices (c, d), respectively, divided into: a) absolute (nominated quantity, showing by how many units the level of the phenomenon has changed in the examined period, in relation to the level of the phenomenon in the period recognized as basic), b) relative (percentage difference showing changes in the examined period compared to the basic period) and c) individual (presents the percentage difference in the phenomenon from the basic period, which is part of the level of the phenomenon in the current period), d) aggregate (enabling the analysis of interrelated phenomena using value, price and quantity).

Single-based ( $x_1$ ) dla  $t = 1, 2, \dots, n$  and chain based ( $x_{t-1}$ ) dla  $t = 2, \dots, n$ :

- Absolute increment

$$\Delta x_{1t} = x_t - x_1 \quad \text{and} \quad \Delta x_t = x_t - x_{t-1} \quad (9)$$

- Relative increment

$$d_{1t} = \frac{x_t - x_1}{x_1} \quad \text{and} \quad d_t = \frac{x_t - x_{t-1}}{x_{t-1}} \quad (10)$$

- Individual index

$$i_{1t} = \frac{x_t}{x_1} \quad \text{and} \quad i_t = \frac{x_t}{x_{t-1}} \quad (11)$$

The medium-period pace of change of the phenomenon over time enables the analysis of the entire time span of the examined phenomenon.

$$\bar{T}_n = (\bar{t}_G - 1) \cdot 100\% = \left( \sqrt[n-1]{\frac{x_n}{x_1}} - 1 \right) \cdot 100\% \quad (12)$$

### 3.3. Correlation

The strength and linear interrelation between two variables is expressed by the correlation coefficient (Czaja, Preweda, 2000). The linear interdependence between variable Y (dependent variable) and variable X (explanatory variable) is the assumed value within  $-1 \leq r_{XY} \leq 1$ . Values approaching one indicate a strong connection between the variables, while its absence is signalled in the case of values close to zero. The coefficient also indicates the direction of the dependence, a positive correlation means that an increase in the value of one variable is accompanied by an increase in the value of the other variable, while a negative correlation informs us that an increase in the value of one variable means a decrease in the other variable. In order to examine the interrelation between variables Y and X (its statistical significance), the correlation coefficient test is used. The study is based on the value read from the T-Student's statistical table ( $T^*$ ) for the adopted level of significance ( $\alpha$ ) and degrees of freedom, and comparing it with the calculated statistics. This test enables you to verify the alternative hypothesis on a significant correlation against the null hypothesis of its insignificance:

$$r_{XY} = \frac{cov(X,Y)}{S_X \cdot S_Y} \quad (13)$$

where:

$$cov(X,Y) = \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y}) \quad (14)$$

$S_X, S_Y$  - standard deviation of the X and Y variable

## 4. Results and Conclusions

The time series analysis on the state of long-period equilibrium between variables describing the size of the population according to age groups (variables  $A_1$  to  $A_5$ ) to the corresponding population of children with disabilities and those learning in special units (variables  $B_1$  to  $H_5$ ) is presented in Table 1.

**Table 1.**  
Cointegration of time series of variables of the studied populations

Relationship of variables	State of long-period equilibrium	
	Model	Apparent Regression
A <sub>1</sub> : B <sub>1</sub>	$\widehat{A}_{1t} = 1,722,444.75 + 116,225.41B_{1t}$	$DW > R^2$
A <sub>2</sub> : J <sub>2</sub>	$\widehat{A}_{2t} = 392,881.53 + 17,657.96J_{2t}$	$DW > R^2$
A <sub>3</sub> : D <sub>3</sub>	$\widehat{A}_{3t} = 2,227,385.37 + 189,300.7D_{3t}$	$DW < R^2$
A <sub>4</sub> : F <sub>4</sub>	$\widehat{A}_{4t} = 2,961,546.99 + 332,030.33F_{4t}$	$DW > R^2$
A <sub>5</sub> : G <sub>5</sub>	$\widehat{A}_{5t} = 1,247,393.41 + 175,144.61G_{5t}$	$DW > R^2$
A <sub>5</sub> : H <sub>5</sub>	$\widehat{A}_{5t} = 1,184,225.48 + 63,364.92H_{5t}$	$DW < R^2$
The degree of integration of individual variables		
	$A_{1t} \sim I(0)$	$B_{1t} \sim I(1)$
	$A_{2t} \sim I(0)$	$J_{2t} \sim I(1)$
	$A_{3t} \sim I(0)$	$D_{3t} \sim I(0)$
	$A_{4t} \sim I(0)$	$F_{4t} \sim I(1)$
	$A_{5t} \sim I(0)$	$G_{5t} \sim I(0)$
		$H_{5t} \sim I(1)$

Source: own work.

Since the degree of integration of the variable describing the population (A) is a stationary series and the basic assumption on the degree of integration of the variables is not met (there is no *d-b* interrelation), further steps regarding the cointegration of two variables and the EMC model were not carried out. Thus, it can be concluded that in Poland there is no long-period interrelation between the number of children attending special facilities and the population of same age.

The dynamics of changes in the studied variables are shown in Table 2. To illustrate the entire study, the medium-period pace of change was used, and to show its cross-section, the initial period (2001/2000), the middle period (2012/2000 and 2012/2011) and the last analysed year (2022/2000 and 2022/2021) were selected. The base year was the first period, i.e. 2000. The analysis of dynamics measures included variables describing the population (A<sub>1</sub> do A<sub>5</sub>), the number of children with disabilities in special schools (B<sub>1</sub> do H<sub>5</sub>) and the number of special facilities (I<sub>B1</sub> do VI<sub>H5</sub>).

**Table 2.**  
Direction and pace of changes in selected variables

Variable	Single-base absolute (relative) increments			$\bar{T}_n$
	X <sub>2</sub> do X <sub>1</sub>	X <sub>12</sub> do X <sub>1</sub>	X <sub>22</sub> do X <sub>1</sub>	
A <sub>1</sub>	-429,596 (-16.78%)	-1,123,645 (-43.89%)	-1,052,760 (-41.12%)	-2.49%
A <sub>2</sub>	-25,368 (-5.46%)	-94,570 (-20.36%)	-76,962 (-16.57%)	-0.86%
A <sub>3</sub>	-152,959 (-3.47%)	-1,413,767 (-32.09%)	-1,142,443 (-25.93%)	-1.42%
A <sub>4</sub>	-24,966 (-0.75%)	-1,027,646 (-30.75%)	-1,563,475 (-46.78%)	-2.96%
A <sub>5</sub>	-36,254 (-0.91%)	-1,141,293 (-28.61%)	-1,851,000 (-46.40%)	-2.93%
<i>total</i>	<b>-669,143 (-4.53%)</b>	<b>-4,800,921 (-32.52%)</b>	<b>-5,686,640 (-38.52%)</b>	<b>-2.29%</b>

Cont. table 2.

B <sub>1</sub>	1,001 (14.80%)	1,328 (19.64%)	26,788 (396.10%)	7.93%
J <sub>2</sub>	-257 (-21.78%)	309 (26.19%)	4,042 (342.54%)	7.34%
D <sub>3</sub>	-7,377 (-12.42%)	-34,938 (-58.82%)	-12,611 (-21.23%)	-1.13%
F <sub>4</sub>	500 (41.74%)	970 (80.97%)	1,710 (142.74%)	4.31%
G <sub>5</sub>	1,335 (4.54%)	-14,486 (-49.25%)	-16,636 (-56.56%)	-3.89%
H <sub>5</sub>	104 (6.74%)	-332(-21.53%)	-627 (-40.66%)	-2.45%
<b>total</b>	<b>-4,694 (-4.72%)</b>	<b>-47,149 (-47.39%)</b>	<b>2,666 (2.68%)</b>	<b>0.13%</b>
I <sub>B1</sub>	-232 (-2.66%)	75 (0.86%)	4,481 (51.31%)	1.99%
II <sub>J2</sub>	-650 (-6.40%)	-1,104 (-10.87%)	-2,547 (-25.09%)	-1.37%
III <sub>D3</sub>	-21 (-2.62%)	-21 (-2.62%)	152 (18.98%)	0.83%
IV <sub>F4</sub>	3 (12.50%)	80 (333.33%)	86 (358.33%)	7.52%
V <sub>G5</sub>	19 (5.96%)	56 (17.55%)	76 (23.82%)	1.02%
VI <sub>H6</sub>	2 (5.88%)	19 (55.88%)	2 (5.88%)	0.27%
<b>total</b>	<b>-879 (-4.38%)</b>	<b>-895 (-4.46%)</b>	<b>2,250 (11.21%)</b>	<b>0.51%</b>
<b>Variable</b>	<b>Absolute chain increments</b>		<b>Chain indexes</b>	
	<b>X<sub>12</sub> do X<sub>11</sub></b>	<b>X<sub>22</sub> do X<sub>21</sub></b>	<b>X<sub>12</sub> do X<sub>11</sub></b>	<b>X<sub>22</sub> do X<sub>21</sub></b>
A <sub>1</sub>	20,768	-1,974	101.47%	99.87%
A <sub>2</sub>	11,611	-3,001	103.24%	99.23%
A <sub>3</sub>	-68,651	15,114	97.76%	100.47%
A <sub>4</sub>	-109,616	15,962	95.48%	100.91%
A <sub>5</sub>	-122,788	6,144	95.87%	100.29%
<b>total</b>	<b>-268,676</b>	<b>32,245</b>	<b>97.37%</b>	<b>100.36%</b>
B <sub>1</sub>	789	11,590	110.81%	152.78%
J <sub>2</sub>	88	2,026	106.28%	163.39%
D <sub>3</sub>	-199	-313	99.19%	99.34%
F <sub>4</sub>	345	287	118.92%	110.95%
G <sub>5</sub>	-642	441	95.88%	103.58%
H <sub>5</sub>	-32	-56	97.42%	94.23%
<b>total</b>	<b>349</b>	<b>13,975</b>	<b>100.67%</b>	<b>115.85%</b>
I <sub>B1</sub>	367	303	104.35%	102.35%
II <sub>J2</sub>	45	-203	100.50%	97.40%
III <sub>D3</sub>	3	-3	100.39%	99.69%
IV <sub>F4</sub>	20	-1	123.81%	99.10%
V <sub>G5</sub>	1	8	100.27%	102.07%
VI <sub>H6</sub>	0	0	100.00%	100.00%
<b>total</b>	<b>436</b>	<b>104</b>	<b>102.33%</b>	<b>100.47%</b>

Source: own work.

The data from the second table clearly show a downward trend in the population growth of children and adolescents. The average year-to-year decrease of the population under study (A<sub>1</sub>-A<sub>5</sub>) was at the level of 2.3%. A detailed analysis of the dynamics until 2014 showed an increase in the number of preschool-age children, since this trend gradually slowed down reaching a positive value in 2012, which then dropped to negative values in 2017. Population decreases relative to the base year were on average at the level of one million people, while the chain equivalent for decreases of population was approximately 120 thousand people and 30-50 thousand for increases. A noticeable change in the trend concerning school-age children occurred in 2014. The pace of decreases slowed down and the population of adolescents over 15 years old began to gradually increase but did not reach positive values. In the case of children with disabilities, the key year was 2010, when the declining population trends turned into increasing ones. They did not last throughout the entire period under study, but for the group of preschool children they came to an average annual increase of over 7%. Special vocational schools also recorded growth, but their dynamics cannot be defined as

a trend. The highest number in both populations concerns school children, while the increase in the number of preschool children with disabilities is directly proportional to its overall population. The number of children attending special vocational schools and secondary schools has been negatively increasing year by year. The analysis of the dynamics of the number of facilities showed an almost 90% structural share of facilities teaching preschool children compared to the total number. The year-to-year decrease by 1.37% in the number of pre-school units in schools is related to an increase in the number of kindergartens for children with disabilities by almost 2%. Other facilities, despite the decreasing population, recorded annual increases. The highest values in relation to the base year were noted in vocational and special trade schools, they increased by approx. 250-300%.

The last research procedure carried out under this study was to examine the level of linear dependence. Table 3 shows the direction and importance of the ratio of the total number of facilities educating children with disabilities to their equivalents, divided by individual Polish voivodeships.

**Table 3.**

*Correlation of variables determining the number of facilities educating children with special educational needs*

Facilities in Poland by age group in individual regions	Facilities in Poland by age group					
	PL(B)	PL(J)	PL(D)	PL(F)	PL(G)	PL(H)
PL <sub>DS</sub>	0.990	0.988	0.949	0.901	0.781	-0.016
PL <sub>KP</sub>	0.911	<b>0.693</b>	0.950	0.714	0.891	-0.299
PL <sub>LB</sub>	0.936	0.973	0.939	0.849	0.812	<b>-0.012</b>
PL <sub>LS</sub>	<b>0.804</b>	0.969	0.661	<b>0.374</b>	0.738	0.375
PL <sub>LD</sub>	0.960	0.958	0.834	0.925	0.894	0.375
PL <sub>MP</sub>	0.915	0.963	0.990	0.807	0.909	0.478
PL <sub>MZ</sub>	0.984	0.993	0.996	0.857	0.860	0.704
PL <sub>OP</sub>	0.958	0.960	<b>0.670</b>	0.876	0.941	-0.299
PL <sub>PK</sub>	0.990	0.977	0.953	0.832	0.895	0.264
PL <sub>PD</sub>	0.968	0.986	0.979	0.907	<b>0.656</b>	-0.299
PL <sub>PM</sub>	0.876	0.986	0.897	0.835	0.954	0.375
PL <sub>ŚL</sub>	0.990	0.998	0.977	0.959	0.990	0.820
PL <sub>SK</sub>	0.970	0.985	0.958	0.762	<b>0.655</b>	-0.375
PL <sub>WM</sub>	0.959	0.984	0.970	0.940	0.778	0.640
PL <sub>WP</sub>	0.991	0.978	0.981	0.946	0.760	0.299
PL <sub>ZP</sub>	0.982	0.989	0.991	0.930	0.825	0.640
<b>Lowest correlation between voivodeships</b>						
PL <sub>LS-KP</sub>	0.592					
PL <sub>LD-KP</sub>		0.540				
PL <sub>LS-LB</sub>			0.397			
PL <sub>MP-LS</sub>				1.308E-17		
PL <sub>PD-LS</sub>					0.061	
PL <sub>LB-PL</sub>						-0.012

Source: own work.

The table above shows the decreasing impact of subsequent groups of facilities on the total number of units attended by children with special educational needs. The division into voivodeships demonstrates that the Masovian and Silesian voivodeships are those in which all types of facilities show a correlation in the range of 0.99-0.64, i.e. at a very high level. What's more, the study of dependencies between voivodeships did not indicate such high results. The first group of facilities (for children up to the age of 6) has the lowest correlation of 0.6-0.7, which occurs between most voivodeships and the Lubusz or Kuyavian-Pomeranian Voivodeship. The lowest correlation values are in the group of vocationally profiled secondary schools and special technical schools, from -0.243 to -0.529.

To sum it all up, the obtained results confirm the general trend of a decreasing population of newborn children and an increased number of children with certificates of disability, which has been present in Poland for years. The growth/decrease interrelation between the population of children and their coevals with disabilities, visible in the dynamics research, does not, however, translate into a state of long-period equilibrium. These conclusions result from the fact that x children with disabilities are part of the total population. Nonetheless, it cannot be said that a trend change in one group will cause the same or opposite result in another group. The increased number of decisions confirming disability results from the easier access to specialists and diagnostic facilities, and also due to actions taken by the Polish government (teams appointed by MEN/MEiN), parents have become more aware of this problem. A good direction is the trend of an increasing number of special facilities, observed in the dynamics study. Bearing in mind the decreasing number of children, we can assume that there will be a sufficient number of places in these facilities. According to the results of the analysis presented as part of the 2020 Substantive Report on inclusive education in Poland, one of the problems reported by the survey respondents were (Podgórska-Jachnik, 2021) regional differences in the profile of activities having psychological and pedagogical support. Their uneven use resulted in the provision of support in the Masovian Voivodeship (with Warsaw as its capital) for almost  $\frac{1}{4}$  of cases. It is therefore important that support for children requiring special education is considered countrywide through the prism of local needs. The study of correlations in regions discussed this paper, indicated the Masovian and Silesian voivodeships as dominant in Poland. Their strong interdependencies regarding subsequent groups of special facilities show the right direction to meet the needs of children and adolescent with disabilities throughout the country. This interrelation is additionally confirmed by the highest number of such facilities in these regions. Therefore, sustainable development of a region demands that special attention be paid to the needs of the community examined in the paper. The annual increase in the number of such facilities, which stands out compared to other voivodeships, should also be a signal for the local governments as intermediary institutions, e.g. in contacts with social economy entities. The growing number of facilities will enable various educational approaches, thus adapt the offer to the requirements of future employers, and contribute to region's development. Ultimately, such actions will improve the

unemployment situation, which at the end of the first quarter of 2023 presented itself as follows: 48.8% (rate of long-term unemployed people out of the total number registered), of which 12.3% were people under 25 years old. The creation of local social and educational policy strategies should therefore be implemented in cooperation with the local government, which, knowing and implementing projects to meet the needs of children with disabilities, will enable the real development of inclusive education.

## References

1. Birkan, B. (2002). Erken ozel eğitim hizmetleri. *Ozel Eğitim Dergisi*, 3(2), pp. 99-110. doi: 10.1501/Ozlegt\_0000000062.
2. Carbonell, J.R. (1970). AI in CAI: An artificial-intelligence approach to computer-assisted instruction. *IEEE Transactions on Man-Machine Systems*, 11(4), pp. 190-202, <https://doi.org/10.1109/TMMS.1970.299942>.
3. Casale, E.G., Golann, D.W., LeMaster, E. (2021). Chapter Seven - U.S. school principals and special education legal knowledge: A scoping review. *International Review of Research in Developmental Disabilities*, Academic Press, Vol. 60, pp. 213-258, <https://doi.org/10.1016/bs.irrdd.2021.08.007>.
4. Charemza, W.W., Deadman, D.F. (1997). *Nowa ekonometria*. Warszawa: PWE.
5. Constitution of the Republic of Poland (1997). *Rozdział II. Wolności, Prawa i Obowiązki Człowieka i Obywatela, art. 70*. Retrieved from: <https://www.sejm.gov.pl/prawo/konst/polski/kon1.htm>, 7.09.2023.
6. CRPD (2007). *Convention on the rights of persons with disabilities*. New York: United Nations. Retrieved from: [https://www.unic.un.org.pl/dokumenty/Konwencja\\_Praw\\_Osob\\_Niepelnospawnych.pdf](https://www.unic.un.org.pl/dokumenty/Konwencja_Praw_Osob_Niepelnospawnych.pdf), 6.09.2023.
7. Czaja, J., Preweda, E. (2000). Analiza statystyczna zmiennej losowej wielowymiarowej w aspekcie korelacji i predykcji. *Geodezja*, vol. 6, no. 2, pp. 129-145. Retrieved from: [https://depot.ceon.pl/bitstream/handle/123456789/8385/Analiza\\_statystyczna\\_zmiennej\\_losowej\\_wielowymiarowej\\_w\\_aspekcie\\_korelacji\\_i\\_predykcji.pdf?sequence=1&isAllowed=y](https://depot.ceon.pl/bitstream/handle/123456789/8385/Analiza_statystyczna_zmiennej_losowej_wielowymiarowej_w_aspekcie_korelacji_i_predykcji.pdf?sequence=1&isAllowed=y). 6.09.2023.
8. Demirok, M.S., Haksiz, M. (2015). The Comparison of Early Childhood Special Education System in Turkey with in Hungary, Italy and Romania. *Procedia - Social and Behavioral Sciences*, Vol. 205, pp. 648-654, <https://doi.org/10.1016/j.sbspro.2015.09.102>.
9. Deng, R., Benckendorff, P. (2020). Technology-Enabled Learning. In: Xiang, Z., Fuchs, M., Gretzel, U., Höpken, W. (eds), *Handbook of e-Tourism* (pp 1-27). Cham: Springer, [https://doi.org/10.1007/978-3-030-05324-6\\_129-1](https://doi.org/10.1007/978-3-030-05324-6_129-1).



10. Engle, R.F., Granger, C.W.J. (1987). Co-integration and Error Correction, Representation, Estimation and Testing. *Econometrica*, Vol. 55, No. 2, pp. 251-276, <https://doi.org/10.2307/1913236>.
11. Franklin, B.M. (Ed.) (1996). *Interpretación de la discapacidad. Teoría e historia de la educación especial*. Barcelona: Ediciones Pomares-Corredor.
12. Jachimczak, B., Podgórska-Jachnik, D. (2023). *Edukacja włączająca w perspektywie i zadaniach samorządu terytorialnego*. Warszawa: Ośrodek Rozwoju Edukacji; Uniwersytet Łódzki, <https://doi.org/10.18778/8331-246-0>.
13. Journal of Law 2023, items 900, 1672 and 1718 (2023). *Ustawa Prawo Oświatowe*. Retrieved from: <https://www.prawo.vulcan.edu.pl/przegdok.asp?qdatprz=07-09-2023&qplikid=4186#P4186A134>, 7.09.2023.
14. Kamble, S.S., Gunasekaran, A., Gawankar, S.A. (2018). Sustainable Industry 4.0 framework: A systematic literature review identifying the current trends and future perspectives. *Process Safety and Environmental Protection*, Vol. 117, pp. 408-425, doi:10.1016/j.psep.2018.05.009.
15. Kosicka, E., Kozłowski, E., Mazurkiewicz, D. (2015). The use of stationary tests for analysis of monitored residual processes. *Eksploatacja i Niezawodność – Maintenance and Reliability*, Vol. 17, Iss. 4, pp. 604-609, <http://dx.doi.org/10.17531/ein.2015.4.17>.
16. Küçükalkan, K., Demirok, M.S., Avcin, M. (2023). Assessment of managerial processes applied in multinational special education institutions. *Heliyon*, Vol 9, Iss. 9, doi: <https://doi.org/10.1016/j.heliyon.2023.e19514>.
17. Lin, CC., Huang, A.Y.Q., Lu, O.H.T. (2023). Artificial intelligence in intelligent tutoring systems toward sustainable education: a systematic review. *Smart Learn. Environ.*, 10(41). <https://doi.org/10.1186/s40561-023-00260-y>.
18. MEiN (2021). *Projektowanie zmiany oparte na modelu edukacji dla wszystkich*. Ministerstwo Edukacji i Nauki. Retrieved from: [www.gov.pl/web/edukacja-i-nauka](http://www.gov.pl/web/edukacja-i-nauka), 6.09.2023.
19. MEN (2010). *Edukacja skuteczna, przyjazna i nowoczesna. Jak organizować edukację uczniów ze specjalnymi potrzebami edukacyjnymi?* Warszawa: Ministerstwo Edukacji Narodowej; Fundacja Fundusz Współpracy. Retrieved from: <http://www.oke.krakow.pl/inf/filedata/files/Jak%20organizowa%E6%20edukacja%EA.pdf>, 6.09.2023.
20. MEN (2017). Zarządzenie nr 39 Ministra Edukacji Narodowej z dnia 13 października 2017 r. w sprawie powołania Zespołu do spraw opracowania modelu kształcenia uczniów ze specjalnymi potrzebami edukacyjnymi (Dz.Urz.MEN.2017.43) .
21. Nowak, E. (2001). *Metody statystyczne w analizie działalności przedsiębiorstwa*. Warszawa: PWE.
22. Podgórska-Jachnik, D. (2021). *Raport merytoryczny. Edukacja włączająca w Polsce – bilans otwarcia 2020*. Warszawa: Ośrodek Rozwoju Edukacji.

23. Public Law 94-142 (1975). *Education for All Handicapped Children Act of 1975, 20 USC 1401*. Senate and House of Representatives of the United States of America. Retrieved from: <https://www.govinfo.gov/content/pkg/STATUTE-89/pdf/STATUTE-89-Pg773.pdf>, 7.09.2023.
24. Ren, X., Li, Y., Shahbaz, M., Dond, K., Lu, Z. (2022). Climate risk and corporate Environmental Performance: Empirical evidence from China. *Sustainable Production and Consumption, No. 30*, pp. 467-477, doi: <https://doi.org/10.1016/j.spc.2021.12.023>.
25. Rodriguez, C.C., Garro-Gil, N. (2015). Inclusion and Integration on Special Education. *Procedia - Social and Behavioral Sciences, Vol. 191*, pp. 1323-1327, <https://doi.org/10.1016/j.sbspro.2015.04.488>.
26. Serafin, T. (2009). *Kształcenie specjalne w systemie oświaty*. Warszawa: Wolters Kluwer Business.
27. Sochacka, K. (2012). Specjalne Potrzeby i Specyficzne Trudności. In: E. Awramiuk (ed.), *Z Problematyki Kształcenia Językowego w Szkole, tom IV* (pp. 179-194). Wydawnictwo Uniwersytetu w Białymstoku.
28. Sterling, S.R., Orr, D. (2001). Sustainable education: Re-visioning learning and change. *Schumacher Briefing, no. 6*. Dartington: Schumacher Society/Green Books.
29. Strahl, D., Sobczak, E., Markowska, M., Bal-Domańska, B. (2004). *Modelowanie Ekonometryczne z Excelem*. Wrocław: UE.
30. Szumski, G. (2006). Edukacja Inklusyjna - Geneza, Istota, Perspektywy. *Kwartalnik Pedagogiczny, 203(1)*, pp. 93-114.
31. UN (1987). *Report of the World Commission on Environment and Development*. United Nations. Retrieved from: <https://digitallibrary.un.org/record/133790?ln=en>, 6.09.2023.
32. UN (2015). *Sustainable development 17 goals*. United Nations. Retrieved from: <https://sdgs.un.org/goals>, 6.09.2023.
33. UNESCO (2023). *Sustainable development begins with education*. United Nations Educational, Scientific and Cultural Organization. Retrieved from: <https://www.unesco.org/en/articles/unesco-sustainable-development-begins-education>, 6.09.2023.
34. UNIC WARSAW (2017). *Osoby z niepełnosprawnością*. Ośrodek Informacji ONZ w Warszawie. Retrieved from: <https://www.unic.un.org.pl/unic-activities/osoby-z-niepelnosprawnoscia/3105>, 6.09.2023.
35. Welfe, A. (2003). *Ekonometria. Metody i ich zastosowania*. Warszawa: PWE.
36. WHA54.21 (2001). *International classification of functioning, disability and health*. Fifty-Fourth World Health Assembly. Retrieved from: [https://apps.who.int/gb/archive/pdf\\_files/WHA54/ea54r21.pdf](https://apps.who.int/gb/archive/pdf_files/WHA54/ea54r21.pdf), 6.09.2023.
37. WHO (2001). *International classification of functioning, disability and health (ICF)*. World Health Organization. Retrieved from: [https://apps.who.int/iris/bitstream/handle/10665/42407/9241545429\\_pol.pdf](https://apps.who.int/iris/bitstream/handle/10665/42407/9241545429_pol.pdf), 6.09.2023.

38. WHO (2019). *Disability, Factsheet*. Sustainable Development Goals: health targets. Retrieved from: [https://www.who.int/europe/publications/m/item/fact-sheet-on-the-sdgs-disability-\(2019\)](https://www.who.int/europe/publications/m/item/fact-sheet-on-the-sdgs-disability-(2019)), 6.09.2023.
39. Ysseldyke, J.E., Algozzine, R., Thurlow, M.L. (2000). *Critical issues in special education*. Boston: Houghton Mifflin.