Revista Românească pentru Educație Multidimensională
ISSN: 2066-7329 | e-ISSN: 2067-9270
Covered in: Web of Science (WOS); EBSCO; ERIH+; Google Scholar; Index Copernicus; Ideas RePeC; Econpapers; Socionet; CEEOL; Ulrich ProQuest; Cabell, Journalseek; Scipio; Philpapers; SHERPA/RoMEO repositories; KVK; WorldCat; CrossRef; CrossCheck

2022, Volume 14, Issue 3, pages: 180-200 | https://doi.org/10.18662/rrem/14.3/604
Submitted: December 21st, 2021 | *Accepted for publication:* June 17th, 2022

Horticultural Therapy Course as an Educational-Therapeutic Tool of Rehabilitation for Persons with Musculoskeletal Disorders (MDs)

Iryna SARANCHA[1],
Mikhaylo KOVINKO[2],
Borys MAKSYMCHUK[3],
Halyna TARASENKO[4],
Sergey KHARCHENKO[5],
Iryna DEMCHENKO[6],
Sofiia DOVBNIA[7],
Liliia RUDENKO[8],
Olesia SYMKANYCH[9],
Tetiana MARTYNIUK[10],
Valentyna BILAN[11],
Iryna MAKSYMCHUK[12]

[1] Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University, Vinnytsia, Ukraine, isarancha@gmail.com
[2] Communal Higher Education Institution «Vinnytsia Humanities Pedagogical College», Vinnytsia, Ukraine, kovmi1978@ukr.net
[3] Izmail State University of Humanities, Izmail, 0674256781@ukr.net
[4] Public Higher Educational Establishment «Vinnytsia Academy of Continung Geducation», Vinnytsia, Ukraine, tarasenkogal@gmail.com, https://orcid.org/0000-0001-9394-2600
[5] Luhansk Taras Shevchenko National University, Starobilsk, Ukraine, hk.sergey2014@ukr.net

Abstract: The article is devoted to theoretical, methodical and implementation problems of horticultural therapy application in the rehabilitation of persons with musculoskeletal disorders (MDs).
In article the complex interdisciplinary approach to the organization of interaction of persons with the impaired musculoskeletal device with floral objects taking into account neurophysiological, psychoemotional and activity factors is applied.
The purpose of the article is to create a theoretical basis for the development of a complex special "Horticultural Therapy" course, its implementation in the rehabilitation process of persons with MDs and evaluate the effectiveness of this implementation by experiment.
The authors used three groups of methods to achieve the goal of the article: general theoretical, methodologically modeling and evaluating (questionnaire before and after the experiment).
The article discussed from a neurophysiological and experimental point of view the appropriateness of adaptation of children and youth with musculoskeletal disorders through communication with nature and active immersion in certain objects, in particular the flora.
The results of the implementation of the special course revealed an increase in the functional ability of persons with MDs by an average of 7% (experimental groups) in various activities of self-care and housekeeping.
Improving the level of self-care and housekeeping by people with MDs depends to a large extent on creating the most barrier-free environment possible; comprehensive development of the physical and psychological abilities of the individual; informed and professional participation of teachers and parents in the process of familiarizing people with MDs with the functions of their own bodies.

Keywords: *natural environment, educational conditions, conductive pedagogy, communication with nature, course implementation, educational-rehabilitational process.*

How to cite: Sarancha, I., Kovinko, M., Maksymchuk, B., Tarasenko, H., Kharchenko, S., Demchenko, I., Dovbnia, S., Rudenko, L., Symkanych, O., Martyniuk, T., Bilan, V., & Maksymchuk, I. (2022). Horticultural Therapy Course as an Educational-Therapeutic Tool of Rehabilitation for Persons with Musculoskeletal Disorders (MDs). *Revista Românească pentru Educație Multidimensională, 14*(3), 180-200. https://doi.org/10.18662/rrem/14.3/604

©2022 Published by LUMEN Publishing. This is an open access article under the CC BY-NC-ND license http://creativecommons.org/licenses/by-nc-nd/4.0/

[6] National University of Life and Environmental Sciences of Ukraine, Kyiv, Ukraine, irynadi67@gmail.com, http://orcid.org/0000-0003-4302-7564
[7] M. P. Drahomanov National Pedagogical University, Ukraine, Kyiv, Ukraine, so.dovbnia@gmail.com
[8] National Pedagogical Dragomanov University, Kyiv, Ukraine, Lilianic1962@gmail.com, ORCID ID https://orcid.org/0000-0003-1655-5708
[9] Uzhhorod National University, Uzhhorod, Ukraine, olesjasi123@gmail.com
[10] Lesya Ukrainka Volyn National University, Lutsk, Ukraine, martynyuk.t@gmail.com, ORCID: 0000-0002-9288-8179
[11] Pavlo Tychyna Uman State Pedagogical University, Uman, Ukraine, valentinaandreevna72@gmail.com, ORCID: 0000-0002-6615-5211
[12] Izmail State University of Humanities, Izmail, 0963113686@ukr.net

Introduction

Most children with movement disorders are detached from direct communication with wildlife. They cannot express themselves and assert themselves as individuals. Psychologists believe that there are no talentless children since everyone has a particular inclination towards something. Therefore, specialists in social rehabilitation centres must help these children to discover themselves, show their abilities, find their place in this world. The most effective and accessible way of correcting influence on the development of the emotional and mental sphere of children with movement disorders is their involvement in communication with nature.

According to Shevtsov (2004) and Ermakov (1998), social rehabilitation of children with special needs should involve developing basic social skills, as well as motivating them towards fruitful interaction with the natural environment (Akatov, 2003). One of the world's recognized technologies for acquiring essential motor skills is conductive pedagogy. The introduction of elements of conductive pedagogy into the socio-educational process implies acquiring everyday skills with the use of all components of the extra-educational environment.

Lately, complex methods of influence have been widely used in corrective pedagogy and rehabilitation, Budyakova (2020). On the other hand, rehabilitation and conductive pedagogy in terms of MDs are considered in many aspects, including rehabilitation organization (Arkadyeva et al., 2019; Fedorenko et al., 2020); psychological rehabilitation programmes (Razuvaeva et al., 2021; Sinkevich, 2018); a synergy of medical treatment and multidisciplinary rehabilitation (Grote et al., 2019).

Scholars and practitioners involved in the social and professional rehabilitation of children and young people with MDs are developing and implementing new methods and techniques of social rehabilitation in rehabilitation centres (Sarancha et al., 2021; Sheremet et al., 2019; Karasievych, 2021; Berbets et al., 2021; Demchenko et al., 2021; Prots, 2021; Kosholap et al., 2021). They contribute to enhancing social adaptation, life activity of children and young people with MDs. One of these methods is horticultural therapy. Unfortunately, there are no fundamental studies and consistent guidelines on horticultural therapy in Ukrainian conductive pedagogy and rehabilitation. At the same time, foreign scholars prove that horticultural therapy encourages individuals with MDs to work with plants and involves the following changes in their physical and psycho-emotional state: developing fine motor skills, skills of independent work on plots of land, household skills; improving orientation in space and logical thinking;

shaping an aesthetic taste; creating conditions for psycho-emotional relaxation (Arkadyeva, et al., 2019; Sinkevich, 2018).

The purpose of this article is to provide a neuroscientific substantiation, content development, and implementation of the course of special course Horticultural Therapy in the educational and rehabilitation process of persons with MDs, as well as to determine the effectiveness of such implementation.

A pilot implementation of the authors' course was set up in a group of 40 individuals (18 males and 22 females) with cerebral palsy (CP) from the Vinnytsia Centre for Social Rehabilitation of Children with Special Needs "Promin" (6 of whom diagnosed with mild mental disorders). The age requirement for EG is 14-19 years old. In the framework of the quasi-experiment, the control group (CG) involved 40 individuals diagnosed with CP and seven individuals with mild mental disorders (23 males and 17 females).

Research ethics. The authors received permission from the local ethics committees of the Department of Work with Persons with Special Needs to implement the special course as an implicit experiment. Also the children in the Center for Social Rehabilitation of Children with Disabilities "Promin" and their parents were warned about the experimental nature of the activity and gave their written consent to participate in it.

International significance of the article. The article correlates with current problems of rehabilitation of persons with MDs in the context of interaction with natural objects. As for the use of Horticultural Therapy itself, the authors prove: "communicating" with plants of patients with neurophysiological disorders (in terms of care and touching their parts) causes a feeling of physiological peace and a wide range of tactile and odarative feelings, which are subjectively qualified mainly as pleasant (soft, smooth, cold, etc.) (Koga & Iwasaki, 2013). Such not yet fully studied adaptation and neurorehabilitation possibilities draw the prospect of using the psychological and neuropsychological effect of tactile touching of plants by patients with cerebral palsy. Also we want to note that scientific reflections, methodical developments and implementation of the course "Horticultural Therapy" are in the actual context with present-day neuro- and psychocorrective theories. Thus, the article corresponds to the idea and the worldwide context of the greening of recreational and rehabilitative areas, which acquired a new universal significance during the COVID-19 pandemic and as part of the spread of ecological consciousness in our time, Burge (2021). This may expand the scope of the subject of Horticultural Therapy in the future. The article also complements phenomenological

research on the impact of "Horticultural Therapy" as a holistic recreation and rehabilitation of patients and individuals experiencing anxiety and psychosomatic disorders in a complex time of uncertainty and global change in the world (Hastuti, 2020).

The authors' original contribution is to develop a comprehensive program to improve housekeeping skills (from self-care - to transformative activities and caring for the wildlife world as an important tool for therapy and rehabilitation). In the context of recent publications on the subject, mostly concerned with general theoretical or partial practical problems of Horticultural Therapy (*see Neuroscience foundations of rehabilitation through communication with nature*) our methodical correction model is comprehensive, with connections to other therapeutic aspects (music, visual arts cognitive activity, etc.). Also the value and originality of the findings is that they are based on years of experience of the authors, holistically presenting the picture of Horticultural Therapy. The authors have repeatedly empirically tested its effectiveness within the framework of the Ukrainian rehabilitation center with maximum access to external objects.

Methods and materials. The data content of this article took place in three directions: study of the relevant literature on the subject of research, modeling the content of education on the basis of the authors' own experience (selection of methods and techniques of Horticultural Therapy from relevant sources and personal experience of the authors of the article) and diagnostic methods at the beginning and end of implementation as a formative experiment.

Let us consider the sequence of application of the research methods that depended on its stage.

1. At the preparatory stage the analysis of theoretical sources and selection of methodical tools which can be realized in the accessible environment of the rehabilitation center were used.
2. On the second - modeling of educational conditions, structuring of educational programs according to the given principles of pedagogy and rehabilitation. This methodology included the selection of types of economic activity correlating with different indicators of readiness for self-care and economic activity according to three criteria - psychophysical, psycho-emotional and activity. We also considered the interaction between the most important aspects of rehabilitation - socialization, connections with natural objects, and the development of neurophysiological dysfunctional skills and functions - from fine

motor skills to manipulative-transformative activity - when modeling.

3. At the implementation stage - methods of expert evaluation of initial and final results and statistical methods. Experts were independent specialists in remedial pedagogy and rehabilitation, whose main method was observation and evaluation of the cognitive, behavioral and psycho-emotional dynamics of persons with MDs.

Let us dwell on the last stage as a demonstration-result. We developed criteria and indicators of the levels of socialization of persons with MDs - graduates of rehabilitation centers, which are the basis for determining the self-care and housekeeping skills of persons with MDs within the framework of interaction with natural objects. We based these criteria on the development of a diagnostic questionnaire (see below) and a 4-point response assessment method.

Table 1 - Criteria and indicators of readiness of persons with MDs for housekeeping and self-care

No	Criteria	Indicators	Score in points
1	2	3	4
1	Psychophysical	- persons with MDs have irreversible psychophysical impairments, which have undergone little or no correction in the conditions of the center for social rehabilitation of children with disabilities.	1
		- persons with MDs have psychophysical impairments, but also individual minor preserved areas of the brain, which served as the basis for further corrective development.	2
		- persons with MDs have insignificant permanent psychophysical impairments, but with a properly created rehabilitative environment, these impairments do not have a major impact on the individual's vital activities.	3
		- psychophysical impairments are permanently controlled and have almost no effect on the individual's activities.	4
2	Psycho-emotional	- persons with MDs are unable to manage on their own and are almost completely isolated	1

		from society. - persons with MDs require constant skilled assistance from others, staying in a well-formed rehabilitative environment. - the ability to make connections with other people and external objects is partial, although the ability to act independently provides a basis for successful development of self-care and housekeeping skills. - communication with people and external objects is constant and comprehensible, basic skills are well corrected.	2 3 4
3	Active	- persons with MDs are unable to manage on their own and are almost completely isolated from society. - persons with MDs need constant help from others, are not vitally competent, but with properly oriented social support have a minimal possibility of economic activity. - persons with MDs sometimes need help from others, but self-actualization in economic activities and self-care is possible. - persons with MDs do not need or are able to organize help from others in everyday life. They are ready for active and conscious self-actualization in activities.	1 2 3 4

Source: Authors' own conception

The scoring system used in the table: 1 - indicator of the initial level of economic activity, 2 - indicator of a low level of economic activity, 3 - indicator of a sufficient level of economic activity, 4 - indicator of a high level of economic activity.

In order to study the levels of socialization of persons with locomotor disorders, we developed a questionnaire to interview the target group, conducted psychological and pedagogical conversations and observations. We also conducted an analysis of the individual rehabilitation programs of the "Promin" center residents and an analysis of the products of the economic activities of persons with MDs.

The preface to the questionnaire explains how to work with the questionnaire and emphasizes the confidentiality of the information obtained in the study. When filling out the questionnaire, each respondent was interviewed beforehand. Respondents were given the following

instruction: "When answering the questions in the questionnaire, we ask you to circle those of the answers that you agree with. You can provide your own answer in the "Other (specify)" box. If you have circled any of the answers by mistake, please cross out the circle crosswise. The answers you give to the questionnaire will be kept completely confidential, so you can be quite sincere during the interview".

The questionnaire contains questions that form several important groups.

The first group of questions refers to self-care and solution of domestic problems, the success of which depends on the practical mastery of relevant skills, as well as infrastructure and the natural environment. The proportion of affirmative answers will determine the degree of independence of the respondents, the rest - the degree of dependence on the environment. The level of achievement motivation is also significant.

The next group of questions characterizes nature as the center of the micro-social environment and the leading institution of socialization of the disabled and the place of the person with a locomotor disability in the parental family. Respondents' relationships with natural objects, the immediate environment (peers, friends), and the environment are important.

Another group of questions highlights the personal orientation of disabled persons in the economic sphere, the degree of motivation, and the localization of the foci of activity of people with disabilities in the natural system (environment).

The last block of questions investigates the respondents' motivation to create their own productive activity as well as the degree of its autonomy. The actual ability to do this determines the prospects of personal growth and the level of actual transformative activity of persons with motor disabilities.

The system of research of socialization levels of persons with MDs proposed by us provided for observance of certain conditions:

1) the questioning should take place in habitual conditions for the teenager in a psychologically close environment;

2) the questioning should be conducted only under condition of satisfactory well-being of the teenager and a positive emotional state;

3) it is necessary to give the teenager some time to adapt and get used to it;

4) it is expedient to avoid positive and negative evaluative comments during questioning.

When processing the results of the questionnaire and compiling tables reflecting the dynamics of economic activity and self-care, we took

into account sufficient and high scores (scores 3 and 4) for individual activities (for each of the above criteria) and gave average values as a percentage.

Neuroscience foundations of rehabilitation through communication with nature

Even though physiological functions of people are adapted to nature, they anyway live in an artificial urban environment. The values of neurophysiologically relevant markers among marginalized and urbanized populations show that destructive neurophysiological indicators decrease, whereas immunity and productivity increase in the natural marginal environment. This proves the potential of nature therapy for preventive medicine and neurocognitive disorders. Regarding the latter, some studies indicate that the activity of the parasympathetic nervous system increased by almost 50% after a long stay of patients in the forest and remained so for a month even after their return to city life.

In practice, neurorehabilitation shows that therapeutic indications for people with psychomotor problems are communication with wildlife. It is mainly about neurotherapeutic communication with animals and less often with other living objects. Such therapy can be of two types: a) communication with living beings in the form of a hobby or entertainment; b) purposeful work under a certain rehabilitation scheme controlled by a rehabilitation specialist and supplemented by special therapeutic indications (Oropesa Roblejo et al., 2009). Alternative types of neurorehabilitation and therapy are now widespread. Besides, they act as an important source of resources for occupational therapists, which gives a proven positive physical and psycho-emotional effect.

Communication with nature often takes place within specialized treatment centres or animal-assisted therapy. Unfortunately, a patient with CP cannot be in the natural environment for a long time. However, even short-term natural effects, such as hippotherapy (30 minutes twice per week for 8 weeks under supervision), can improve walking speed and balance in children with bilateral spastic CP if there are no indications (Kwon et al., 2011). Thus, it is possible to organize at least a sessional communication with objects of nature in specialized rehabilitation centres, which will be reflected in specific clinical results.

The term "one health" is gaining popularity as being inseparable from human well-being and condition. The presence of animals or plants has been proven to improve the state of patients with neurological disorders subjectively and temporarily. Long-term studies show that regular

communication with the living world first affects emotional and gradually neurophysiological states (Palley et al., 2010).

Only in the 2000s, the therapeutic role of animals and plants in neurorehabilitation and anti-stress therapy has become the subject of specific studies. A review of many articles on neurorehabilitation in CP, developmental disorders, multiple sclerosis, spinal cord injuries, stroke and mental disorders has allowed to conclude the following: communication with the fauna increases several mental and neurological functions: improvement in social functioning and interaction; reductions in stress, anxiety and loneliness; decreased spasticity with improved balance (Lasa et al., 2015). However, the researchers claim that "these interventions, performed with highly specialised animals in very specific neurological populations, deliver an increasing body of scientific evidence suggesting that they are an effective complement to other existing therapies". At the same time, in these diseases, further high-quality studies are warranted to define the most appropriate programmes for therapy (Lasa et al., 2015). Therefore, more research is needed to determine the adaptive potential of nature for individuals with neurophysiological disorders.

Today, people develop mainly in the social context (family, school), which contributes to adaptation or socialization. Still, archaic neurophysiological mechanisms are focused on survival and adaptation in natural conditions, which can be used as a rehabilitational and adaptive potential for some neurological disorders. This is especially true for disorders accompanied by negativism about society, maladaptation, autistic accentuations. Being in society contributes to the integration of mental and neurological processes, as well as the development of "cognitive, emotional and social intelligence" (Eslinger & Tranel, 2005). However, the environmental factor becomes decisive in the adaptation process. The natural environment evokes new associations and neural connections, changes one's self-esteem and develops new navigation mechanisms in the new landscape. In addition, communication with nature, unlike society, is characterized by slower decision-making, low-stress levels and other positive factors for individuals with CP.

Advances in neuroscience have made it possible to establish reciprocal and longitudinal links between the social environment and the executive functions from childhood to adolescence. Indeed, labour activity launches self-regulation mechanisms, which become the main therapeutic tool of rehabilitation. As noted by Dishion, the main mission of neuroscientists is to expand "the analysis of executive function to include a wider array of predictive adaptive responses to various environmental

conditions, including those where youth are chronically marginalized or otherwise stressed". Also, the researcher states that the obtained results show that "the executive functions within the brain guide adaptation in both deviant as well as competent responses to the social environment" (Myasishchev, 1960; Dishion, 2016). Thus, it is essential to diversify forms of adaptation since it will reduce the destructive social and iatrogenic impact on people with nervous disorders.

Physical work with natural objects is one of the oldest human functions. Even though the human neocortex is a manifestation of the higher evolution, it is still associated with phylogenically old structures. Measurement of brain activity may be sub-optimal if one wishes to visualize brain function in individuals in real-world environments (Kasai et al., 2015). However, such measurement corresponds to today's neuroparadigm that "has historically developed through generations of the "sensing brain," "emotional brain," "social brain," and "ego brain", and "the next generation is the "action brain" combined with "real-world neuroscience" perspective" (Kasai et al., 2015).

The leading neuroscientific methods of adaptation are cognitive rehabilitation and social rehabilitation. Regarding brain disorders, these areas need maximum correction. There is a new branch of social cognitive neuroscience that studies the neurophysiological mechanisms of socio-affective and cognitive-executive processes of activity and behaviour. This approach is suitable for developing a heuristic model of social outcomes and social competence (Yeates et al., 2007). Besides, occupational therapy (if the client is not isolated due to clinical indications) is also part of socialization (teamwork).

Therefore, occupational and recreational rehabilitation of individuals with MDs in natural conditions or close to them can be an effective means of adaptation through the interaction with natural objects (animals and flowers), as well as the actualization of phylogenic archaic mechanisms. This fact prompts one to verify the hypothesis by developing and implementing the specialized course "Horticultural Therapy" in rehabilitation centres.

The implementation of the specialized course "Horticultural Therapy" in rehabilitation centres

The authors' model of socialization of individuals with MDs has been implemented into the practice of the Vinnytsia Centre for Social Rehabilitation of Children with Special Needs "Promin". Since the course was implemented as part of a formative-diagnostic quasi-experiment, the authors agreed on all ethical aspects of such work with children with MSDs.

The thematic planning elaborated during the formative experiment is shown in Table 2.

Table 2. A year-long lesson plan for the implementation of the authors' methodical complex "Horticultural Therapy"

Topic	The number of hours
Introduction to Horticultural Therapy; Introduction to the Rich World of Nature	1 h
Safety Rules	1 h
The Flora as an Integral Part of Nature. The Diversity of Living Organisms, Their Habitat	1 h
An educational trip to the station of young naturalists	1 h
A Collection of Various Natural Material and Rules for Its Drying and Storage	1 h
Organs of Plants. Root and Root System.	1 h
Shoot and Its Structure. Propagation of Plants by Shoots	2 hrs
Propagation of Plants by Shoots (a practical lesson)	2 hrs
Stem and Its Inner Structure. Leaf. A Variety of Leaves.	2 hrs
Introduction to Floristics. How to Use Relevant Literature.	1 h
Arranging Compositions from Natural Material (a practical lesson). Flower. A Variety of Colours.	3hrs
Care Rules for Cut Flowers (a practical lesson).	2 hrs
An Overview of Different Types of Flower Arrangements.	1 h
The Floristics Profession	3 hrs
An educational trip to a flower shop	1 h
Forms and Patterns of Flower Arrangements	1 h
Arrangements of Artificial Flowers. Arranging Flowers	1 h
Floral Decorations for All Holidays (a practical lesson)	2 hrs
Making Christmas Ornaments (a practical lesson)	2 hrs
Working in the Winter Garden	1 h
Characteristics of Plant Care in the Winter Garden	1 h
Soil Care (a practical lesson)	2 hrs
Planting in Soil (a practical lesson)	2 hrs
Replanting Houseplants (a practical lesson)	2 hrs
Rules of Working in Greenhouses. An educational trip to a greenhouse	2 hrs
Seeds and Fruit. Planting Plants in Soil	2 hrs
Collecting Seeds. Planting Seeds in Soil	2 hrs
Seedling Care. Caring for Plants on the Plot	2 hrs
Caring for Plants on the Plot (a practical lesson)	3 hrs

Harvesting. Tree Care	3 hrs
The Agriculture Profession	2 hrs
An educational trip to Vinnytsia National Agricultural University	1 h
Summaries	1 h

Source: Authors' own conception

The objectives of "Horticultural Therapy" lessons are as follows: 1) 1) to teach individuals with MDs to see, perceive and feel the beauty of nature; 2) to develop their aesthetic feelings towards nature; 3) to teach them not only to understand and love also continually preserve and care for nature; 4) to develop their aesthetics skills and views, as well as the ability to see and understand the beauty; 5) to inspire them to work independently; 6) to make them more aware of the environment.

The methods and ways of teaching the specialized course "Horticultural Therapy" correspond to the year-long lesson plan and depend on the natural environment of the Centre, the location and object of observation, the age of children and their psychophysical conditions.

The learning process within the authors' methodical complex "Horticultural Therapy" is based on different methods:

1. *Practical teaching methods* (exercises, independent work, educational games, educational trips). The respondents with MDs needed to perform many exercises during horticultural therapy lessons (e.g., the exercises aimed at teaching them how to use tools for plant care and work on the land). Didactic games took place at different stages of lessons, mostly at the end of the lesson to revise the material (e.g., "Who knows more houseplants?", "Who can do better and more?").

2. *Visual teaching methods* (educational films, pictures, postcards, photographs). The painting requires special techniques for working with it. The children must comprehend its contents and imagine the objects depicted on it. Therefore, the pupils themselves needed to disclose the content of the picture with the help of auxiliary questions. The following paintings were offered for discussion: "In the Spring" and "The Steppe River" by Vasylkivskyi (2013), "The Winter" and "The Oak Grove" by Shishkin (1984). As a result, the children managed to memorize the material better.

3. *Verbal teaching methods* (stories, explanations, conversations). Visual aids and children's activities should always accompany such methods. The story was used when it was necessary to characterize the structure of plants and soil in an accessible form. The explanations were short, accessible, clearly stated and concise.

It was essential to apply the elements of music therapy, visual art therapy, art therapy, bibliotherapy (e.g., reading stories, drawing plants, making applications from natural material) to enhance the healing effect of horticultural therapy and help individuals with MSDs acquire the necessary competencies.

Demonstrations and instructions also play an essential role in familiarizing individuals with MSDS with nature and developing their skills of independent work.

It was crucial to familiarize the children with the general principles of *floristics* before studying the topics of floristics. Therefore, they were offered to observe some homemade arrangements. After that, they became acquainted with a wide selection of arrangements in the catalogues and learned how to use them.

The authors have also created *a nature study corner* and used the winter garden of the rehabilitation centre within the framework of the authors' methodical complex "Horticultural Therapy".

The following *forms* of interaction can help the children complete the programme of the authors' complex:

1. *Lessons*. It is the main form of acquainting individuals with MDs with nature. Lessons were held at certain hours according to the lesson plan. They aimed to familiarize the children with nature, develop their cognitive skills, speech and interest in nature. It is essential to teach them how to work. They should strive to complete the work so that everyone can enjoy the results.

2. *An educational trip* is an activity during which children with MDs can familiarize themselves with nature under usual conditions: in the woods, in the field, in the garden, in the grove. Daily walks have been widely used to familiarize such children with nature. During educational trips, they had the opportunity to observe nature, the weather, seasonal changes in the life of plants. Collecting exciting gifts of nature and making various products from them, they learned many new and exciting things and realized the beauty of nature.

3. *Working on land*. It was vital not only to acquaint children with nature but also to teach them to communicate with it. One of the conditions for this was the establishment of *the winter garden centre*. The participants had the opportunity to work and observe the plants all year long. They accustomed themselves to caring for the plants, acquired the necessary working skills, learned how to work with adults, with each other and independently. The organization of work for individuals with MDs depends on their psychophysical skills.

4. *Practical activities with plants*. The Vinnytsia Centre for Social Rehabilitation of Children with Special Needs "Promin" has a plot of land on which children with MDs spend most of their time, especially in the warm season. It is a place for *games, walks, lessons, observations* of plants and animals *watching* throughout the year. The presence of trees, bushes, vegetable garden, flower garden, fruit and berry plantations is of great educational importance. The participants with MDs, together with their teachers, grew plants, looked after them and observed their growth and development.

Comparing results in EG and CG at the end of the quasi-experiment, the authors noticed that the participants with MDs enhanced their household skills after improving self-care skills (see Table 3).

Table 3. Types of household activities

Types of activity	EG		CG	
	Before experiment	After experiment	Before experiment	After experiment
	%	%	%	%
Heating the food	85	90	87.5	87.5
Taking the rubbish out	75	77.5	77.5	80
Cleaning	70	75	72.5	72.5
Buying essentials	65	70	62.5	62.5
Making a simple meal	55	62.5	57.5	57.5
Washing	50	67.5	52.5	55
Ironing	47.5	55	50	50

Source: Authors' own conception

The knowledge, skills, and abilities acquired during the experiment make it possible for individuals with MDs to take a more conscious and realistic approach to plan their future. The results of the experiment are presented in Table 4.

Table 4. Abilities and skills of individuals with MDs

Abilities and skills	EG		CG	
	Before experiment	After experiment	Before experiment	After experiment
	%	%	%	%
Communicating	62.5	77.5	65	67.5
Maintaining the accommodation	55	65	52.5	52.5
Spending money wisely	42.5	67.5	45	45
Maintaining good health	37.5	55	35	35
Living independently with social support	52.5	60	55	57.5
Planning a budget	50	62.5	52.5	52.5

Source: Authors' own conception

As can be seen from the observations of specialists from the Centre, after the introduction of the specialized course "Horticultural Therapy" in the system of social rehabilitation, individuals with MDs have acquired the following knowledge and abilities: 1) the knowledge about safety rules on land and in greenhouses; 2) the knowledge about the structure of plants and the differentiation of plants, trees, bushes, herbaceous plants; 3) the ability to plant them appropriately; 4) the ability to observe how people work and draw useful conclusions for themselves; 5) the ability to care houseplants, as well as plants in the winter garden and on plots of land; 6) the knowledge about the rules of arranging flowers and the ability to arrange flowers.

Arranging flowers taught children with MDs to observe and study the surrounding nature, analyze and summarize the acquired knowledge, develop their creative skills and aesthetic taste, expand the scope of aesthetic education and develop their personality. It also had some psychotherapeutic effects since it relieved nervous and psychological tension.

The method of horticultural therapy also teaches such individuals to see the beauty, understand it, human relationships, actions, poetry, work, life, improves their cognitive activity and enriches their emotions and imagination.

As evidenced by the authors' observations, the development of such children's attitude towards objects in the outside world is characterized by greater mediocrity, less flow of sensory stimuli and impressions. Motor

deficiency leads to specific difficulties in the visual-spatial orientation and the perception of objects.

Conclusions

According to the goal set in the introduction, we can now draw three groups of conclusions:

1. In the article we have argued from the neurophysiological point of view the expediency of adaptation of children and youth with locomotor disorders through communication with nature and active immersion in certain objects, in particular flora. We took into account, first of all, the neurophysiological factor: all children with developmental disabilities have rather difficult to form external social and psycho-emotional connections and fine motor skills - fine motor skills, coordination of movements and orientation in space, and they need a motivated natural operational-manipulative activity.
2. The authors have developed and implemented the specialized course aimed at developing the knowledge about botany; teaching them to perceive, feel and understand the beauty of nature, work, people's actions towards nature; familiarizing them with the basics of floristics and agriculture. The authors' methodical complex is based on the use of the following methods: physical exercises, independent work, didactic games, educational trips, work on plots of land, flower arrangement, work with plants, educational films, pictures, leaflets, photos, stories, explanations, conversations, music therapy, visual art therapy, art therapy, bibliotherapy. Caring for plants, the participants in the quasi-experiment learned to use simple tools for cultivating the land and developed a caring attitude towards nature.
3. The obtained results confirm that the enhancement of self-care and household skills in individuals with MDs depends, to a large extent, on the creation of the barrier-free environment; the comprehensive development of physical and psychological skills; the conscious and professional involvement of educators and parents in the process of familiarizing individuals with MDs with the functions of their body. Self-care skills are an essential component of socialization of children and adults with MDs, which will allow them to lead the most independent way of life.

Thus, the implementation of the proposed conditions in special correctional education has significantly improved social and household skills in EG respondents with MSDs. Also, they have managed to increase the level of their independence, reinforce social and personal incentives for communication with nature and enhance self-care and household skills. Importantly, there are significant shifts in their awareness of their limitations and willingness to use their strengths. After the quasi-experiment, they can interact with peers and adults better and do not feel such social tension in their families.

Acknowledgments

The equal contribution of the authors to this article lies in a rational combination of theoretical, analytical, modelling (the specialized course) and experimental work. Despite the theoretical nature of the article, the authors have managed to partially apply quasi-experimental and diagnostic methods to verify the effectiveness of the authors' programme of the specialized course.

References

Akatov, L. (2003). *Sotsial'naya reabilitatsiya detey s ogranichennymi vozmozhnostyami zdorov'ya* [Social rehabilitation for children with disabilities]. VLADOS Humanitarian Publishing Center.

Arkadyeva, N. V., Khanbabayeva, O. Ye., Khanbabayev, R. K., & Oleynik, S. S. (2019). Gardenoterapiya, kak sposob samorealizatsii i samorazvitiya dlya detey shkolnogo vozrasta s ogranichennymi vozmozhnostyami zdorovya [Horticultural therapy as a way of self-realization and self-development for schoolchildren with special needs]. *Vestnik landshaftnoy arkhitektury* [Journal of Landscape Architecture], *17*, 11–14. https://elibrary.ru/item.asp?id=39820133

Berbets, T., Berbets, V., Babii, I., Chyrva, O., Malykhin, A., Sushentseva, L., Medynskii, S., Riaboshapka, O., Matviichuk, T., Solovyov, V., Maksymchuk, I., & Maksymchuk, B. (2021). Developing Independent Creativity in Pupils: Neuroscientific Discourse and Ukraine's Experience. *BRAIN. Broad Research in Artificial Intelligence and Neuroscience*, *12*(4), 314-328. https://doi.org/10.18662/brain/12.4/252

Budyakova, L. V. (2020). Metod konduktivnoi pedagogiki v sisteme reabilitatsii detey s DTsP [The method of conductive pedagogy in the system of rehabilitation for children with cerebral palsy]. In A. Akhulkova (Ed.), *Perspektivy otraslevogo vzaimodeystviya v kompleksnoy reabilitatsii* [Prospects for

Industry Cooperation in Complex Rehabilitation] (pp. 29–33). Turgenev Orel State University. https://elibrary.ru/item.asp?id=46459235

Burge, R. (2021). Remarkable garden: Broughton Hall 150 years of garden therapy. *Australian Garden History, 32*(3), 31–32. https://search.informit.org/doi/10.3316/informit.640769267224692

Demchenko, I., Maksymchuk, B., Bilan, V., Maksymchuk, I., & Kalynovska, I. (2021). Training Future Physical Education Teachers for Professional Activities under the Conditions of Inclusive Education. *BRAIN. Broad Research in Artificial Intelligence and Neuroscience, 12*(3), 191-213. https://doi.org/10.18662/brain/12.3/227

Dishion, T. J. (2016). Social influences on executive functions development in children and adolescents: Steps toward a social neuroscience of predictive adaptive responses. *Journal of Abnormal Child Psychology, 44*, 57–61. https://doi.org/10.1007/s10802-015-0117-5

Ermakov, I. (1998). *Zhyttyetvorchyy potentsial reabilitatsiynoyi pedahohiky* [The life-creating potential of rehabilitation pedagogy]. Kyiv.

Eslinger, P. J., & Tranel, D. (2005). Integrative study of cognitive, social, and emotional processes in clinical neuroscience. *Cognitive and Behavioural Neurology, 18*(1), 1–4. https://pubmed.ncbi.nlm.nih.gov/15761271/

Fedorenko, S. M., Balazh, M. S., Vitomskyi, V. V., Lazarieva, O. B., & Vitomska, M. V. (2020). Economic components of the morbidity and rehabilitation of the musculoskeletal system as factors of the organization of the system of physical therapy at the ambulatory stage. *Health, Sport, Rehabilitation, 6*(1), 57–65. http://dx.doi.org/10.34142/HSR.2020.06.01.07

Grote, V., Unger, A., Puff, H., & Böttcher, E. (2019). What to expect: Medical quality outcomes and achievements of a multidisciplinary inpatient musculoskeletal system rehabilitation. In M. Bernardo-Filho, D. C. de, & R. Taiar (Eds.), *Physical Therapy Effectiveness* (pp. 65–91). IntechOpen. https://doi.org/10.5772/intechopen.89596

Hastuti, A. S. O. (2020). Healing garden therapy: a phenomenology of holistic healing for patients. In *3 rd SPUP International Research Conference Journal*. http://repository.stikespantirapih.ac.id/id/eprint/375

Karasievych, S., Maksymchuk, B., Kuzmenko, V., Slyusarenko, N., Romanyshyna, O., Syvokhop, E., Kolomiitseva, O., Romanishyna, L., Marionda, I., Vykhrushch, V., Oliinyk, M., Kovalchuk, A., Halaidiuk, M., & Maksymchuk, I. (2021). Training Future Physical Education Teachers for Physical and Sports Activities: Neuropedagogical Approach. *BRAIN. Broad Research in Artificial Intelligence and Neuroscience*, *12*(4), 543-564. https://doi.org/10.18662/brain/12.4/264

Kasai, K., Fukuda, M., Yahata, N., Morita, K., & Fujii, N. (2015). The future of real-world neuroscience: Imaging techniques to assess active brains in

social environments. *Neuroscience Research*, *90*, 65–71. https://doi.org/10.1016/j.neures.2014.11.007

Koga, K., & Iwasaki, Y. (2013). Psychological and physiological effect in humans of touching plant foliage – using the semantic differential method and cerebral activity as indicators. *Journal of Physiological Anthropology, 32*(1), 1–9. https://doi.org/10.1186/1880-6805-32-7

Kosholap, A., Maksymchuk, B., Branitska, T., Martynets, L., Boichenko, A., Stoliarenko, O., Matsuk, L., Surovov, O., Stoliarenko, O., & Maksymchuk, I. (2021). Neuropsychological Bases of Self-Improvement of Own Physical Health of Future Teachers in the Course of University Education. *BRAIN. Broad Research in Artificial Intelligence and Neuroscience, 12*(3), 171-190. https://doi.org/10.18662/brain/12.3/226

Kwon, J. Y., Chang, H. J., Lee, J. Y., Ha, Y., Lee, P. K., & Kim, Y. H. (2011). Effects of hippotherapy on gait parameters in children with bilateral spastic cerebral palsy. *Archives of Physical Medicine and Rehabilitation*, *92*(5), 774–779. https://doi.org/10.1016/j.apmr.2010.11.031

Lasa, S. M., Bocanegra, N. M., Alcaide, R. V., Arratibel, M. A., Donoso, E. V., & Ferriero, G. (2015). Animal assisted interventions in neurorehabilitation: A review of the most recent literature. *Neurología (English Edition)*, *30*(1), 1–7. https://doi.org/10.1016/j.nrleng.2013.01.010

Myasishchev, V. N. (1960). *Osnovnyye problemy i sovremennoye sostoyaniye psikhologii otnosheniy cheloveka* [Basic problems and the current state of human relations psychology], vol. 2. Academy of Pedagogical Sciences of the RSFSR.

Oropesa Roblejo, P., García Wilson, I., Puente Saní, V., & Matute Gaínza, Y. (2009). Terapia asistida con animales como fuente de recurso en el tratamiento rehabilitador [Animal-assisted therapy as a source of resources in rehabilitative treatment]. *Medisan*, *13*(6), 1–9. http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1029-30192009000600015

Palley, L. S., O'Rourke, P. P., & Niemi, S. M. (2010). Mainstreaming animal-assisted therapy. *ILAR Journal*, *51*(3), 199–207. https://doi.org/10.1093/ilar.51.3.199

Prots, R., Yakovliv, V., Medynskyi, S., Kharchenko, R., Hryb, T., Klymenchenko, T., Ihnatenko, S., Buzhyna, I., & Maksymchuk, B. (2021). Psychophysical Training of Young People for Homeland Defence Using means of Physical Culture and Sports. *BRAIN. Broad Research in Artificial Intelligence and Neuroscience, 12*(3), 149-171. https://doi.org/10.18662/brain/12.3/225

Razuvaeva, T. N., Lokteva, A. V., Gut, J. N., & Pchelkina, E. P. (2021). Programma psikhologicheskoy reabilitatsii lits s priobretennymi narusheniyami oporno-dvigatelnogo apparata [The program of psychological rehabilitation of persons with acquired disorders of the musculoskeletal system]. *Vestnik*

Samarskogo gosudarstvennogo tekhnicheskogo univrsiteta. Seriya: Psikhologo-pedagogicheskie nauki [Journal of Samara State Technical University Psychological and Pedagogical Sciences], *18*(2), 31–42. https://doi.org/10.17673/vsgtu-pps.2021.2.3

Saranchа, I., Maksymchuk, B., Gordiichuk, G., Berbets, T., Berbets, V., Chepurna, L., Golub, V., Chernichenko, L., Behas, L., Roienko, S., Bezliudna, N., Rassskazova, O., & Maksymchuk, I. (2021). Neuroscientific Principles in Labour Adaptation of People with Musculoskeletal Disorders. *BRAIN. Broad Research in Artificial Intelligence and Neuroscience*, *12*(4), 206-223. https://doi.org/10.18662/brain/12.4/245

Sheremet, M., Leniv, Z., Loboda, V., & Maksymchuk, B. (2019) The development level of smart information criterion for specialists' readiness for inclusion implementation in education. *Information Technologies and Learning Tools*, *72*, 273-285. https://doi.org/10.33407/itlt.v72i4.2561

Shevtsov, A. (2004). *Suchasni problemy osvity i profesiynoyi reabilitatsiyi lyudey z vadamy zdorovya* [Current problems of education and professional rehabilitation of people with health problems]. Socinform.

Shishkin, I. I. (1984). *Perepiska. Dnevnik. Sovremenniki o khudozhnike* [Correspondence. A diary. Contemporaries about the artist]. Art. http://biography.artyx.ru/books/item/f00/s00/z0000007/index.shtml

Sinkevich, V. A. (2018). Gardenoterapiya kak usloviye uluchsheniya psikhoemotsionalnogo sostoyaniya lyudey s ogranichennymi vozmozhnostyami [Horticultural therapy as a condition for improving the psycho-emotional state of people with special needs]. In S. D. Matyushkova, S. G. Tubolets, & N. E. Shabanova (Eds.), *Povysheniye kachestva professionalnoy podgotovki spetsialistov sotsialnoy i obrazovatelnoy sfer* [Enhancing Professional Training of Specialists in Social and Educational Spheres] (pp. 213–216). Vitebsk State University named after P. M. Masherov. https://rep.vsu.by/handle/123456789/14002

Vasylkivskyi, S. (2013). *Ukrayinska dolya Dykoho Polya. Kataloh vystavky* [The Ukrainian fate of the wild field. The exhibition catalogue]. Book Master. http://uartlib.org/allbooks/sergiy-vasilkivskiy-ukrayinska-dolya-dikogo-polya-katalog-vistavki/

Yeates, K. O., Bigler, E. D., Dennis, M., Gerhardt, C. A., Rubin, K. H., Stancin, T., Taylor, H., & Vannatta, K. (2007). Social outcomes in childhood brain disorder: A heuristic integration of social neuroscience and developmental psychology. *Psychological Bulletin*, *133*(3), 535–556. https://psycnet.apa.org/buy/2007-06095-009