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TEACHER SELF-EFFICACY, ATTITUDES TOWARD CHANGE AND NEUROEDUCATION PERCEPTION: TOOL PACKAGE DEVELOPMENT

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Abstract

Neuroeducation is an emerging research field that bridges neuroscience and education in an interdisciplinary manner, aiming to increase the efficiency and efficacy of the educational process. This research is a part of a larger doctoral study, which focuses on the questions of whether and how Israeli teacher training students from the special education course of study implement motifs from the neuroeducation field in their lesson planning. Specifically, this pilot study attempted to compose a validated and reliable package of questionnaires related to the effects of implementing neuroscience motifs in education of teacher self-efficacy and attitudes toward change in teaching methods. The questionnaires were to be presented in Hebrew as a preparation for the quantitative section of a broader research with Israeli participants (Israeli teacher training students in special education studies). Since no specific instruments were found in the literature regarding the inclusion of neuroeducation in the teaching practices, several items were added to previous existing questionnaires after consultation with an expert panel. A number of 19 students participated in the pilot study by filling in online questionnaires. The internal consistency of all the questionnaires (Cronbach's α) was acceptable to excellent. The results present a valid assessment package for the Israeli pre- service teacher population including items specifically related to neuroeducation. Further recommendations and implications for educational use of neuroscience motifs in teaching methods are addressed.

Keywords: Neuroeducation, teacher self-efficacy, attitudes toward change.

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1. Introduction

This paper presents the first stage of the research design of a broader doctoral thesis in which its main subject refers to neuroeducation (NE), a domain that combines research fields of different areas such as neuroscience, psychology, cognitive science and education and it perceives learning as a biological process (Devonshire & Dommett, 2010; Rodgers, 2015). The major objective of the doctoral research is to develop and assess a neuroscience motifs- based teacher training program (NTP) for Israeli special education (SE) students. The specific objectives of the research are: (1) to design and implement the NTP for student teachers of Special Education, (2) to explore the ways students assimilate themes from the neuroscience field in planning the lessons for Special Education pupils, and (3) to examine student's levels of self-efficacy and attitudes toward implementing the NTP. In accordance to the specific objectives, the research questions examine whether the NTP affects the implementation of motifs from the NE field as it is shown in lesson planning for SE pupils. Research questions are: How does the NTP affect teacher self-efficacy of SE student teachers towards using NE motifs in teaching? How does the NTP affect the attitudes of the SE student teachers towards using NE knowledge as a teaching method? What are the processes students go through while learning, constructing and implementing knowledge from the NE field? In order to design and decide on the questionnaires included in the quantitative section a pilot study was conducted, which is presented in this paper. The data collection took place through the academic year 2017-2018 in the Special Education departments of two teacher training Colleges of Education in the center of Israel.

1.1 Theoretical background

A growing number of researchers in the field of education have shown interest in developing a new science of learning that can contribute to evidence-based policy and practice in education (Ansari, DeSmedt, &Grabner, 2012; Meltzoff, Kuhl, Movellan, & Sejnowski, 2009). According to this approach, educators should know how students, especially in SE, optimally require, retain and apply knowledge in creative ways. The emerging field of NE has much to offer in this regard (Hardiman, 2012), since neuroscience may have profound implications for teaching practices addressing individuals with disabilities (Kosaraju, Gorman, & Berry, 2014). Hence, research from the neuro- and cognitive sciences have the potential to improve pedagogical practices and develop creative problem-solving abilities (Carew & Magsmen, 2010).

Only a few studies in the literature have examined the relationship between findings from the neuroscience (NS) field while implementing them into practical educational processes, despite the perception that science-based instruction can be an advantage to the educational process (Busso & Pollack, 2015). Pickering & Howard- Jones (2007) reported educators' enthusiasm for NE from a sample of teachers attending NS professional development courses. Following these promising results, Serpati and Loughan (2012) expanded the findings into a questionnaire to assess teachers' perceived importance of NE. However, no specific questionnaires were found in Hebrew for Israeli students or teachers in terms of assessing the expectations and the effects of NE training on their procedural teaching knowledge. Also, no research was found that examined the way motifs from the NE field are implemented, beginning from the stages of planning lessons for special education pupils. Most of the studies involved in the field of NE

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combined imaging procedures and learning assessment. One of the ways of assessing the ability of integration NE knowledge in teaching methods is by examining the students' self- efficacy, and since the students start their in-service training from the beginning of their first year of studies, the concept chosen for this research is teacher self- efficacy (TSE). TSE refers to teachers' beliefs in how to organize and execute actions to accomplish specific tasks of teaching, or the judgment of their capabilities to bring about desired outcomes of pupils engagement and learning, even among those pupils who may be difficult or unmotivated (Ferreira, 2013). Tschannen-Moran and Hoy (2001) developed the TSE Scale (TSES), which has been widely used in teacher education research since (e.g. Klassen, Usher, & Bong, 2010; Yoo, 2016). Nevertheless, no valid translation of this questionnaire into Hebrew was found. Several valid TSE questionnaires were found in Hebrew language, such as the TSE questionnaire by Lazar (2014), which was also chosen for this pilot study. Since one of the main goals of the study is to evaluate specific TSE to integrate concepts from NS to education, and since no specific questionnaire on that topic was found in English or in Hebrew, some items related to NE were added to Lazar's questionnaire (2014).

Another interest of this study was related to the teacher training students' attitudes toward the implementation of neuroscience in education. Since no such specific questionnaire was found on this aspect, it was decided to investigate the students' attitudes towards inducing changes in teaching methods. According to Fullan (2007), making a change depends on significant personal experience and understanding the importance of the change and its contribution, which is why it is important to investigate the students' attitudes. Two questionnaires were chosen for this purpose as described below.

2. Problem Statement

Since there is a lack of research questionnaires addressing neuroeducation in general, the need to develop a package of questionnaires related to self-efficacy and to the attitudes toward implementation of motifs from the neuroeducation field was identified. In order to investigate these variables in teacher training students in Israel, the Hebrew versions of the questionnaires were further analyzed for their psychometric properties.

3. Research Questions

In accordance to the specific objectives of the main doctoral study, the pilot study presented here are in line with the need of developing a valid package of tools to answer the following research questions: How does the NTP affect teacher self-efficacy of SE student teachers towards using NE motifs in teaching? How does the NTP affect the attitudes of the SE student teachers towards using NE knowledge as a teaching method?

4. Purpose of the Study

The main purpose of this study was constructing the quantitative section of the broader doctoral research, by creating a reliable package of questionnaires with optimal level of comprehension in Hebrew language. More specifically, the pilot study intended to provide a tool package to evaluate specific dimensions related to inclusion of NE in the educational practices in Israel, such as TSE and attitudes toward integrating concepts from NS to education

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5. Research Methods

This pilot study presents the procedure of constructing the quantitative section of a broader doctoral research, which included searching for, adjustment and validation of the questionnaires chosen for the thesis. A two phase sequential mixed methods paradigm was chosen for the doctoral research in order to achieve inclusion of the study's findings and more specifically to learn about the process students go throughin implementing concepts from the NE field (Creswell, 2009; Tashakkori & Teddlie, 2010).

5.1. Population

A number of 19 participants took part in the pilot study. The age of range between 23 to 67 years (mean 37.4). Most participants (84%) were female, secular (73.7) and unmarried (63.1%). All the participants reside in the center of Israel. The majority of them studied in the two colleges in which the doctoral study was carried out (73.6%) and half of them (52.8%) were student-teachers in special education, whereas 37% were studying towards an academic career change for special education teachers. Above two-thirds (68.4%) previously studied a NS course in various fields (e.g., Neuropsychology, Developmental Aspects of Brain Science, Brain aspects of learning disabilities, etc.).

5.2. The Pilot Study (tool package development)

Five types of questionnaires were included in the pilot study. The participants were first asked to fill in a demographic questionnaire by defining their gender, age, family status, degree of religiosity, living area, academic institute, main topic of the degree and note if they previously studied any academic course related to brain science.

5.2.1 Attitudes toward change questionnaire:

This tool was based on the template of "Attitudes toward Change" questionnaire (Priester & Petty, 1996, cited in Zach, 2012). The questionnaire includes 18 items which are grouped into three dimensions: the positive dimension (willing to make the change) the negative dimension (resistance to change) and the conflict experience related to the attitude. Answers are given on a Likert scale which includes 5 points (from 1- "*do not agree at all*" to 5- "*agree very much*"). The alpha Cronbach for each of the three parts of the questionnaire was higher than $\alpha = .80$. A change was implemented in this questionnaire, so that each time the word "change" appeared, it was replaced by "combining knowledge from NS in education".

5.2.2. Teacher perception of neuroeducation questionnaire

(Serpati &Loughan, 2012, based on Pickering & Howard- Jones, 2007): The questionnaire includes 13 items which assess the importance of neuroeducation as perceived by teachers, using a 5 point Likert Scale (1- *unimportant*, 5- *very important*) and three items on a 5- point Likert Scale (1- *completely disagree*, 5- *completely agree*) asking teachers about the importance of NE as a teacher in general and in the specific NTP. The general alpha Cronbach was $\alpha = .90$. This questionnaire was translated into Hebrew by two independent translators. After the translation, it was decided to divide the questionnaire into three parts, as it follows (note: 7 items with specific content related to NTP were added to the original form): 10 items referring to the importance of understanding scientific contents from NS field in education and

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teaching-, 5 items referring to the importance of combining NS in education and 5 items about teachers' roles regarding combining NS in education. In order to validate these changes, consultations were held with four neuroeducation and methodology experts separately.

5.2.3. Teacher self-efficacy questionnaire(Lazar, 2014) based on Soodak & Podell (1996):

This tool was presented in Hebrew after validation and translation from English. It contains 25 items divided into 2 dimensions: personal efficacy of the teacher and efficacy of teaching. Answers are given on a 5-points Likert scale (from 1- "*do not agree at all*" to 5- "*agree very much*"). The alpha Cronbach for this test was α= .88. Six items were added to this questionnaire to describe teacher self-efficacy especially for using content from the NS field in teaching.

5.2.4. A questionnaire of attitudes toward the introduction of changes in teaching methods (Maskit, 1998, in the Hebrew language).

The questionnaire consists of 5 parts. *Attitudes toward changes in teaching methods*(part 1) refers to cognitive and affective aspects (14 items). Participants are asked to rate on a Likert scale how much the item looks reasonable (1- "*not at all*" to 4- "*very much*") and how much the participant identifies himself with the item (1- "*not at all*" to 4- "*very much*"). 11 items regarding attitudes toward changes in teaching methods constituted the willingness aspect (part 2). The answers were given on a Likert scale, referring to the amount of time they are willing to invest in introducing changes (1- "*not at all*" to 4- "*more than 4 hours a week*"). The attitudes toward changes (part 3) refers to the behavioural aspects and factors involved in the process of introducing changes (4 closed questions and one open question). This part was not chosen for this research since it refers to the teachers who work for many years in schools. The forth part includes factors influencing processes of introducing changes (10 items on a 6-points Likert scale: 1- "*not helpful at all*" to 6- "*help the most*"). The fifth part includes teacher perceptions of the teaching profession (15 items on a 4-points Likert scale: 1- "*do not agree at all*" to 4- "*agree very much*". The alpha Cronbach for the total score of the questionnaire was α= .88.

5.2.5. Teacher Self Efficacy scale (TSES, by Tscannen-Moran &Woolfolk Hoy, 2001).

The questionnaire contains 36 items divided into 3 dimensions: Efficacy for instructional strategies, efficacy for classroom management and efficacy for student engagement. Answers were given on a 9-points Likert scale (from 1- "*None at all*" to 9- "*A great deal*"). The alpha Cronbach for the total score was α= .90. The questionnaire was translated and validated into the Hebrew language by comparing two independent translators.

5.3. Procedure

The sampling was based on convenience, i.e. participants were contacted by email and were asked to fill out an online questionnaire and comment if something was not clear. Each participant received a gift voucher worth 30 NIS for a book shop. Most of the participants were former students of the researcher who completed their degree and received their grades.

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6. Findings

6.1. Adjustment, Validation and Reliability of the Questionnaires

During the construction of the pilot questionnaires, an adjustment regarding the collection of the answers was made in order to create a homogenous5-point Likert scale of measurement(1=*not at all* to 5 = a *very high extent*). Also, Likert scales that originally had only four points were recoded without the middle point (3 = somewhat). Responses to all items were set as mandatory, as well as gender, year of birth and institution of study.

Adjustments in the questionnaires were performed following logical and statistical considerations as it follows:

Logical considerations: (a) deletion of ambiguous or unclear items; (b) general statements that are not clearly explained or not related directly to the topic of the scales; (c) items which express extreme attitudes (e.g., "I am willing to sign a petition against introduction of NS in teaching and learning"); (d) items which state intention but not necessarily a cognitive, behaviour or emotional aspect of an attitude (i.e., "I am willing to…"); (e) items were deleted if similar items expressed the same idea in a more accurate wording.

Statistical considerations: (a) items that were worded oppositely to the scales direction and that their meaning was not clear; (b) items that had no variance i.e., all participants agreed or disagreed with the content of the item; (c) low correlation between the item and the rest of the items included in the scale (this was tested in several rounds of deletion of items) – which lead to a raise in scale reliability.

After the pilot study, a few adjustments were made as it follows:

Elimination of questions: a few questions were eliminated because all the answers were similar, the question was found irrelevant to the aims of the study or it produced only one answer (such as: What in-service course on NS did you take?).

Amendment of wording: some items were rephrased as the answers revealed some misunderstanding of the expected answers (such as: "Which previous NS course did you take?" was changed to "Specify the name of the previous NS course" (i.e. because one respondent wrote the name of the lecturer instead of the name of the course).

The questionnaires included in the final version of the tool package after the pilot study were the following:

6.1.1. An Attitudes Toward Change Questionnaire

This scale includes six items (out of the original 18 items). The items 2,3,4 are reversed in meaning. Strong agreement (5) represents positive attitude towards change – combining knowledge from NS research in education. The overall reliability of the scale is acceptable (α = .763). All items (except #3) are sufficiently (above .40) correlated with the other items of the scale – but it was not deleted due its ability to measure change from pre- to post- tests.

6.1.2. Teacher Perception of Neuroeducation

Three sub-scales were created in this questionnaire:

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Sub-scale 1 - The importance of understanding scientific contents from the NS Fieldin education and teaching

This sub-scale includes ten items (all from the original questionnaire). A high score (5) represents high importance related to understanding scientific contents from the NS field. The overall reliability of the scale is good (α = .80). Most items are sufficiently (above .40) correlated with the other items of the scale.

Sub-scale 2: The Important of Combining NS in Education

This sub-scale includes five items (one item was deleted from the original questionnaire). A high score (5) represents high importance related to combining NS in education. For example: "The importance of combining NS in education is by preventing inaccurate interpretation of scientific knowledge". The overall reliability of the scale was α = .73. Most items were sufficiently (above .40) correlated with the other items of the scale.

Sub-scale3: Teachers' Roles regarding Combining NS in Education

This sub-scale includes five items (four items were deleted from the original questionnaire). Strong agreement (5) represents a positive attitude towards change – combining knowledge from NS research in education. The overall reliability of the scale was high (α = .86). All items were sufficiently (above .40) correlated with the other items of the scale.

6.1.3. Teacher Self-Efficacy

This scale includes 19 items (out of the original 31 items). Strong agreement (5) represents high teacher's self - efficacy. The overall reliability of the scale was high (α = .89). To the original scales, 6 items that relate to self-efficacy regarding combining NS in education were added and their reliability was tested separately. General SE in teaching had a value of α=.85,and SE in combining NS in teaching and learning had a value of α=.80. An exploratory factor analysis will be carried out in the main study to check whether the subjects do perceive the items as belonging to two separate scales (the number of participants in the pilot study, *n*=19, is not sufficient to run a statistical Factor Analysis).

6.1.4. A Questionnaire of Attitudes toward the Introduction of Changes in Teaching Methods

Four sub-scales were identified in this questionnaire:

Sub-scale 1: Attitudes toward changes in teaching methods: cognitive and affective aspects

This sub-scale includes nine items (out of the original 14 items). A high score (5) represents strong agreement with each statement related to introduction of changes into teaching methods. The overall reliability of the scale is high (α Cronbach = .85).

Sub-scale 2: Attitudes toward changes in teaching methods: willingness aspect

This sub-scale includes ten items (one item was deleted from the original questionnaire). A high score (5) indicates that the respondent is very willing to invest time in introduction of changes in his/her teaching methods. The overall reliability of the scale was high (α-Cronbach = .79). Most items were sufficiently (above .40) correlated with the other items of the scale.

Sub-scale 3: Factors That May Assist in Introduction of Change Processes

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This sub-scale includes all original nine items (the wording of item #2 - "lack of budget" was expanded in order to make it clearer and to focus it on the core of the scale – "lack of sufficient budget to introduce the change"). Strong agreement (5) represents high impact (assistance) of each factor on introduction of change process. The overall reliability of the sub-scale is acceptable (α Cronbach = .77). A few items had a relatively low (less than .40) correlation with the other items of the scale but they were maintained in the final scale in order to assure the content validity of the scale. In addition, on the pre-test data a Factor Analysis will be used in order to determine if these factors consist of separate sub-scales.

Sub-scale 4: Teacher perceptions

This sub-scale includes five items which are focused on teachers' perception of teaching as evidence based (the other nine items measure general perceptions of teaching as a profession – a scale that is irrelevant to the present study and therefore the items were deleted). Items 1 & 5 are reversed in meaning according to their overt content. Strong agreement (5) represents strong belief that teaching should be an evident based profession. The overall reliability of the sub-scale is acceptable (α = .72). All items (except #2) are sufficiently (above .40) correlated with the other items of the scale. Although items #1 and #5 are expected to be in reverse meaning to other items of this scale, it appears that the participants in the pilot study might have not paid enough attention to the meaning of these items. Therefore, these items will be included in the final scale and their reliability will be retested on the pilot data.

6.1.5. Teacher Self Efficacy Scale (TSES)

This scale includes all the 24 items of the original version (Tschannen-Moran & Hoy, 2001). Strong agreement (5) represents students' strong beliefs that they have high abilities and competence in teaching. The overall reliability of the scale is very high (α = .97). All items are sufficiently (above .40) correlated with the other items of the scale.

The following table 01 presents the list of the final questionnaires which were and will be submitted twice: *pretest* – at the beginning of the academic year and *posttest* – at the end of the academic year to an estimated number of 90 Israeli students enrolled in a NE training program.

Table 01. List of final package of questionnaires (including their identified sub-scales)

	Scale name	# of Items	Cronbach's α[1]	Range of Measurement scale	Variables name
1	Attitude towards Change – Combining Knowledge from NS Research in Education	6	.763	1=strongly disagree, 5=strongly agree	_ATC_C_NS_EDUC
2	Teachers' Perception of the Importance of Knowledge From the Field of NS in Education and Teaching				
2.1	Understanding scientific contents from NS field is important to the following topics	10	.80	1=not important at all, 5=very important	D1_IOU_NS
2.2	The Important of Combining NS in Education	5	.73	1=not important at all, 5=very important	D2_IOC_NS_ED

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2.3	Teachers' Roles Regarding Combining NS in Education	5	.857	1=strongly disagree, 5=strongly agree	D3_TR_IC_NS_ED
3	Teachers' Self Efficacy	19	.89	1=strongly disagree, 5=strongly agree	E_SE
4	Attitudes towards Introducing Change in Teaching Methods	9	.85	1=strongly disagree, 5=strongly agree	F1_ATC_in_TM_relate
5	The Amount of Time teachers are Willing to Invest in Introduction of Changes in their Teaching Methods	10	.79	1 = not willing to at all, 2 = willing a little (1-2 hours a week), 3 = willing to a certain extent (3-4 hours a week), 4 = willing to a high extent (more than 4 hours a week) 5 = very willing (all the time)	F2_ATC_in_TM_Time
6	Factors that may assist in introduction of change processes	9	.763	1=does not assist at all, 5=assists very much	F3_ATC_in_TM_factors
7	Teachers' perception of teaching as evidence based	5	.72	1=strongly disagree, 5=high ability / competence	F4_ATC_in_TM_P_of_Teach
8	Teachers' Beliefs about their Abilities and Competences	24	.763	1=strongly disagree, 5=high ability / competence	G_Chall_Teachers

7. Conclusion

The purpose of this pilot study was to formulate the quantitative section of a doctoral thesis on the subject of implementing motifs from neuroscience in education. The questionnaires were selected from the literature review based on the research questions addressing the students' self-efficacy and attitudes toward change in teaching methods. A lack of questionnaires specific to the neuroeducation field led to the decision to implement adjustments in some of the existing questionnaires. Based on the preliminary data gathered through this pilot study, it can be concluded that a valid and reliable package of questionnaires with optimal level of comprehension (in Hebrew language) was developed for the doctoral research. The decision to adjust and add questions/items was grounded on logical and statistical considerations, followed by consultation with expert researchers to strengthen the validity of the study. The preliminary results indicate that the Hebrew versions of the questionnaires are reliable and valid. Thus, one of the possible contributions of this study is to enable the academic community in Israel to have access to valid instruments for the assessment of variables related to teaching process and implementation of NE programs.

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