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Introduction

This work is dedicated to the methodology of measuring parental involvement in children's education. It includes the description of the changes in the theoretical approaches to parental involvement, the instruments of measuring parental involvement at different time points and an illustration of implementing the instruments in research practice.

Parental involvement (PI) is a complex construct that has been defined as “parental participation in the educational processes and experiences of their children” (Jeynes, 2010); “any action taken by a parent that can theoretically be expected to improve student performance or behavior” (McNeal, 2014); and “manifestations of parents' commitments to their child's education” (Bakker & Denessen, 2007). In practice, researchers choose very different aspects of parental activities to operationalize parental involvement, a situation that leads to inconsistent definitions of parental involvement in different studies (Wilder, 2014).

Being a complex construct, parental involvement can be operationalized in different ways. Wilder (2014) lists operationalizations such as checking homework, home supervision, homework assistance, parent-child communication about schools, education expectations, participation in school activities, communication with the schools, reading with children, parenting style, parental attitudes towards education. Pomerantz et al. add such aspects as motivation, parental beliefs and investments (Pomerantz, Moorman, & Litwack, 2007). Bakker & Denessen (2007) write about limiting TV, setting rules, encouraging sports and organizing cultural outings. In attempts to systematize these definitions, PI practices are divided into home-based vs school-based; controlling vs autonomy supportive; or naturally occurring PI behavior vs facilitated via parenting programs (Pomerantz, Moorman, & Litwack, 2007). The need to include a PI measure in an educational study raises the question of which measure(s) of PI to choose from the range of aspects describing this loosely defined construct.

Apart from the difficulties of operationalization, measuring PI is associated with other specific challenges. First, PI is a culturally dependent construct, related to the historical, demographical, political, and economical situations of people (Hornby, 2007). Second, PI may be prone to a social desirability bias in the respondent's answers. Studies have shown that most parents tend to rate themselves as involved or very involved, and systematic response bias in parents' answers “should be considered as a major problem” for the validity of measures (Bakker & Denessen, 2007). Previous suggestions about how to minimize this bias (e.g. triangulation involving asking parents, children and teachers about PI) have not resolved the problem (Bakker & Denessen, 2007), and qualitative methods, such as in-depth interviews, are time-consuming and generally not appropriate for large-scale assessments.

Difficulties related to the development of parental involvement scales are well documented. For example, ‘Family Involvement Questionnaire-Elementary’ (FIQ-E) (Manz, Fantuzzo, & Power, 2004) demonstrated factor instability between samples; “The Alabama Parenting Questionnaire” (Frick, Christian, & Wootton, 1999) has low reliability of some scales; the effect of social desirability cannot be ruled out of the interpretation of scales (Walker et al., 2005).

Despite the fact that many manifestations of parental involvement are of a different nature, they are all related to children’s academic development. In a meta-synthesis Wilder (2014) analyzed seven meta-analyses dedicated to relationships between parental involvement and various academic outcomes of children. Wilder concluded that the relationship between parental involvement and academic achievement was positive, regardless of parental involvement operationalization or measure of achievement (e.g. standardized test score, school grade or teacher’s rating score). These findings were consistent across grade levels and ethnic groups (Wilder, 2014).

This explains why researchers include parental involvement scales in the design of educational studies along with social and economic status variables and other family characteristics (such as family composition).

Russian Federal Law “On education” No273 (2012) states that parents, students and schools are “ the three subjects of education” which explains why it is important to take into account the role of parents when analyzing student progress in primary school. Many psychological and sociological studies on the phenomenon of parenting and parent-child interactions can be found in the Russian-language literature (eg., Zaharova, 2014; Gurko, 2008; Polovanova, Vopilova, Nisskaya, 2015; Mertzalova, Goshin, 2014; Polivanova, 2018; Goshing, Mertzalova, 2019; Goshin, Grigoriev, Mertzalova, 2019). However, these studies do not measure educational attainments of children. International comparative studies provide variables of both parenting characteristics and educational results (eg., Zaharov, Kapuza, 2018), still the context parenting scales from PIRLS (Progress in International Reading Literacy Study) and TIMSS (Trends in Mathematics and Science Study) have such limitations as their retrospective nature, when parents of fourth-graders are asked about activities four years ago (Hogrebe, & Strietholt, 2016).

This work was motivated by:

1. The demand for parental scales to control for parenting factors in educational studies;
2. The need to overcome methodological difficulties related to the construct complexity, its cultural specificity and the social desirability effect.

This study follows two interrelated goals:

1. To develop the methodology and instruments for measuring parental involvement in educational studies;
2. To implement these to analyze the results of primary school children.

Theoretical framework

The theoretical framework of this study is Item Response Theory (IRT). IRT is a modern standard for test development and analysis because it:

- provides results of the measurement on interval scales (compared to ordinal scales of classical test theory);
- provides individual errors of measurement for each respondent and each item
- allows the analysis of scale category functioning and optimizing the number of answer categories.

Two schools of thought within IRT differ in terms of measurement approaches.

Rasch measurement states that objective measurement should provide a hypothesis about the model and future scale characteristics (Wright & Masters, 1989). The researcher tests the chosen theoretical framework instead of adopting the better-fitting model to data. The poor data-model fit in Rasch measurement means that the instrument should be modified till the expectations are reached. In other words, the desirable properties of a scale should be supported at the stage of scale development (Mead, 2010).

The IRT approach, in contrast, allows fitting different models till the best data-model fit is reached. In other words, the emphasis is on the analysis of the scale and on the choice of the best fitting model.

This work is done using Rasch measurement.

Our research question is as follows:

How can parental involvement into children's education be measured taking into account the complexity of the construct?

Practical relevance of the results of the study includes three areas:

1. Using the developed tools in quantitative educational studies. Two scales of PI were developed and validated in this study. They can now be used in educational studies.
2. Using the methodology of scenario scales to measure other complex constructs. The scenario scale developed in this work was the first of its kind in the Russian language and introduced the methodology to other educational researchers in Russia.
3. Doing a secondary analysis of the data collected to answer research questions related to children's development in primary school. The illustration of 'reactive hypothesis' testing is provided as an example of such research usability.

Methodology of scenario scales

This methodology describes an alternative approach to measuring parental involvement using scenario scales.

This scenario approach to scale development includes an integration of Rasch measurement principles and Guttman facet theory design (Ludlow et al., 2014). The Rasch principles include: (a) items should measure a single construct, (b) items should cover a wide range of content, (c) item difficulty levels should be uniformly spread across the construct's continuum, (d) items should follow a clear theoretically justified hierarchical progression in their difficulty, (e) items should equally differentiate between high and low scoring respondents, (f) the response to one item should not influence the response to another item, and (g) items that do not fit the underlying theory of the construct should be removed.

Guttman facet theory includes both design and analysis components but the Rasch/Guttman scenario approach exclusively draws upon facet theory design because of its capacity to guide the systematic development of scenario items through the identification of a construct's "facets", which are the "concepts and contexts that guide empirical observations" (Borg & Shye, 1995, p. 13) or "sets of elements (i.e., dimensions, types, classes, categories, attributes, etc.) that classify objects of interest" (p. 25). Facets, in other words, are the different components of an underlying construct along which individuals may vary.

The Rasch measurement principles provide the framework for building an instrument comprised of a hierarchical continuum of "lived-experience" scenarios. Guttman facet theory design facilitates the process of operationalizing the construct by breaking it into essential facets and then creating a "sentence map" template, which specifies the facets at various levels of intensity (Guttman & Greenbaum, 1998).

Scenario-based scales have been successfully developed to measure the productive engagement of older adults (Ludlow et al., 2014; Ludlow, Matz-Costa & Klein, 2019), teachers'

enactment of practice for equity (Chang et al., 2019), readiness to return and participate in the community by psychiatric rehabilitation clients (Shen & Ludlow, 2018), living a life of meaning and purpose (Ludlow et al., 2019), and college faculty out-of-class availability (Reynolds, 2019).

The development of scenario scales include the following stages:

Step 1. Identification of essential facets, based on previous theoretical and applied research; 'facets' here are understood as critical components of the complex parental involvement construct. Our set of PI facets includes: (a) home-based, learning-related activities; (b) educational outings and extracurricular activities; (c) school-based involvement; and (d) time and effort invested in maintaining the child's well-being (how much parents take into account the child's academic and extracurricular interests, and mental and health abilities and limitations when planning for the child's educational schedules and trajectories). Each of these four facets may be described as ranging from lesser to greater degrees of involvement, and they are all used together to define each scenario.

Step 2. Development of meaningful narratives describing how each of these facets manifests in the behavior of people with higher, medium and lower levels of the facet expressions. The function of facet narratives is to provide rich detailed qualitative descriptions of parental behaviors which can then be used in scenarios as indicators of parental involvement levels, on the one hand, and facilitate the interpretation of results, on the other hand. In essence, these descriptions define what a parent "looks like" at different levels of parental involvement.

Step 3. Creation of a sentence map template and scenario item specifications. Our scenario development specifications included: (a) all scenario sentence structures should follow the order of the facets presented in Step 1; (b) scenarios should as much as possible avoid socio-economic-related descriptions e.g., references to parent's education or family resources; and (c) lower level scenarios, which are descriptions of relatively un-involved parents, should sound non-judgmental, e.g. the wording should be positive even when the scenario depicts a relatively undesirable level of parental involvement.

Step 4. Development of scenarios. Based on the mapping template and its narrative descriptions, nine scenario items were developed. "High PI" scenarios were written to be difficult/hard for parents to achieve high scores. That is, parents would find it hard to rate their level of involvement higher than parent "X" depicted in a high level PI scenario. "Low PI" scenarios were written to be easier for parents to rate their level of involvement as higher than parent "X" in the scenario.

The table below contains the examples of three scenarios: one for the higher, medium, and lower levels of parental involvement.

Examples of scenarios of high, medium and low parental involvement

[High PI] Fedor checks daily how his child copes with homework and whether the child needs his help. Each week he takes his child to a museum or educational tour to illustrate school subjects in real life. Fedor is an active member of a parent committee where he organizes extracurricular activities. Fedor respects his child's opinion about what and how the child wants to learn.

[Medium PI] Tatiana usually monitors how her child is prepared for a new school day, and she helps her gather a school bag. At least once a month she brings her child to a museum, library or theater. She attends the key parent-teacher conferences (first and last in the year) and some school events. Tatiana insists that her child gets good results on some principle subjects (for Tatiana they are English and math).

[Low PI] Lidia sometimes asks the child if homework is done. Sometimes she dreams about hiring a special person to look after school things for her child instead of herself. She believes that her life situation does not allow her to participate in school life apart from parenting chats. Lidia thinks that her child should strictly follow the teacher's requirements.

The instructions state: "Please read the descriptions of different parents. Decide how much, in general, each of them is similar to, or different from, your typical situation. Choose one answer". The response options are worded with the aim of avoiding negative wording in comparisons, e.g. "Evaluate your involvement in your child's education compared to X' [X=name of a scenario character]". The responses are scored from 1-to-5 with 5 being the highest and hardest-to-attain level of PI. The score values are not seen by the respondent.

"I am involved in the child's education much more than X". This response is scored 5.

"I am involved in the child's education more than X". This is a 4.

"I am involved in the child's education equally with X". This is a 3.

"X is involved in the child's education more than I". (Instead of "I am involved less than X" which would be a negative wording and might be more susceptible to social desirability issues). This is a 2.

"X is involved in the child's education much more than I". This is a 1.

Respondent scale scores range from 9 (the lowest level of PI) to 45 (the highest level of PI).

Step 5. Discussions of the scenarios with psychologists and education experts; cognitive laboratories; subsequent adjustments. During the cognitive lab stage we assessed how the scenario items were interpreted by parents of primary school students in think-aloud sessions.

Step 6. Piloting, analysis and subsequent adjustments. The scenarios were piloted on a sample of 388 Moscow parents in autumn 2017.

Step 7. Final scale administration. The final PI scenario scale (Parental Involvement SCenarios: PISC-9) consists of one training scenario and 9 operational scenarios. The scale is presented in the following order, based on our theoretical predicted scenario difficulty: training scenario-medium-high-medium-low-high-low-medium-low-high. The scale was administered in the Republic of Tatarstan, in the autumn of 2017, on a sample of 1930 parents. The sample was representative of the Tatarstan regions, school types and school sizes.

The main results

Four groups of results were achieved in the research.

First, the history of research on the construct ‘parental involvement’ was described including the models of parental involvement and the main outcomes of the studies which emphasized the cultural specificity of the PI construct.

Second, the scale to measure parental involvement in the pre-school period was redeveloped in three iterations. The development and analysis of this scale is interesting because of, first, it demonstrated the methodological difficulties related to measuring such a complex construct as parental involvement. Second, the original scale was adapted from the context questionnaire “Early Literacy and Numeracy Activities Before Beginning Primary School” from the studies TIMSS and PIRLS (US TIMSS and PIRLS 2011 Technical Report and User's Guide, 2013). One of limitations of these scales is that they are retrospective, and ask parents about their activities four years ago. Answering question about distant past events parents can be affected by the current academic achievements of their child and the teacher’s expectations. One of the goals of this study was to assess the scale functioning on parents of first graders. The scale demonstrated dimensionality problems and the ceiling effect. After the modification of some items, the problems were partly resolved. The modified scale fits the rating scale model (Wright, Masters, 1982), which methodologically better fits this questionnaire than the partial credit model (Masters, 2016), used for the original TIMSS-PIRLS 2011 (US TIMSS and PIRLS 2011 Technical Report and User's Guide., 2013). As a result, the scale with good psychometric properties was obtained.

Third, to measure parental involvement during primary school a new approach was chosen because the construct is more complex. Scenario scale approach is based upon facet theory of L. Guttman and the principles of measurement of G. Rasch (Ludlow, 2014). According to the scenario approach we considered parental involvement as a complex holistic construct (instead of choosing the “best indicators”). Based on literature and empirical data four facets of parental involvement were chosen. The facets became the base for nine scenarios. Each scenario described parental behavior of high, medium and low academic involvement. Respondents were

asked to compare their behaviours with the scenarios on a five-point answer scale. The scale was administered to 1930 parents of third-graders in Tatarstan Republic in 2017. The psychometric analysis of the scale demonstrated its excellent characteristics. The empirical distribution of the items difficulties corresponded to the theoretical. The scale had a high reliability, good fit-statistics with the rating scale model and the correct functioning of the answer categories. In a separate study on a sample of 635 parents from Krasnoyarsk we administered the shortened version of the scale consisting of six scenarios. The scale had excellent psychometric properties and stability (the correlation of item difficulties with the relevant items from the 9-scenario scale was 0,97). These results showed that the scale itself can be used in research, on the one hand, and that the scenario approach can be used for the development of scales for complex constructs. At the time of administration in 2017 it was the third scenario scale in the world and the first scenario scale in the Russian language. Today, there are more than ten published scenario scales and new ones are being developed because the scenario approach proved its strength for measuring complex behavioural constructs.

Fourth, the data collected using the scenario scale of parental involvement were used to answer research questions in order to demonstrate the practical application of the scale. Using two-level regression analysis we tested the so-called “reactive hypothesis” of parental involvement. This hypothesis states that the increased parental involvement is explained by a child’s poorer previous achievements. Using the results of parental involvement scale as a dependent variable we analyzed the data of more than one thousand mothers and their children which were collected during two waves with a break of 2.5 years. Using the data about previous academic results of children, parental pre-school involvement and the social-economic characteristics of the families we did not confirm the reactive hypothesis. The results will be useful for practitioners who develop programs of parental involvement because we demonstrated the variety of the ways parents are involved in their children’s education according to other characteristics of children of families, such as the presence of siblings, gender, mother’s education, and books at home.

Theoretical novelty of the work: this work checks the hypothesis about the holistic nature of ‘parental involvement’ and, the feasibility to measure it using unidimensional models. This approach to PI is novel and different from the traditional practice of choosing ‘the best’ indicators which often led to multidimensional but unstable scales (Wilder, 2014). The results of the analysis supported the correctness of our hypothesis.

Points for PhD thesis defense

1. Classical Likert scales are useful for relatively simple constructs such as pre-school parental involvement or for measuring separate aspects of complex constructs. Measuring school-time parental involvement is associated with such problems as multidimensionality, structure instability, ceiling effect, low reliability and difficulties in interpretation.

2. As a complex holistic construct parental involvement can be measured using scenario scale approach using Guttman's facet theory and Rasch measurement principles. This is proved by the excellent psychometric properties of the parental involvement scenario scale and correspondence between theoretical and empirical item difficulties.

3. The level of parental involvement in the middle of primary school can be explained by a large number of factors related to a child's cognitive and non-cognitive development and the family characteristics. This supports the complexity of the construct and demonstrated the importance of flexibility and adaptively of parental involvement programs.

CONCLUSION

This work is dedicated to the methodology of measuring parental involvement in educational studies. The literature review showed that parental involvement is a complex construct and has a variety of operationalizations. For more than 50 years, several models of parental involvement were described and numerous results were obtained regarding the link between parental involvement and children's academic achievements. However, the scales to measure parental involvement demonstrated inconsistency and psychometric limitations. We showed how to overcome them using the example of relatively simple constructs (pre-school parental involvement) and complex construct (parental involvement when their children attend primary school).

The resulting scales have good psychometric properties and can be used in educational studies. Scenario methodology of scale development was described in detail and can be used for the development of scales in other research fields.

We re-conceptualized the phenomenon of parental involvement as a holistic but complex construct and tested this approach to the construct.

As an illustration of the practical application of parental scales we tested the reactive hypothesis of parental involvement.

In the theoretical part, a new approach to parental involvement as a holistic complex construct was given. In the area of methodology, the scenario scale approach was verified and

described in detail. In the area of practice, we used children's academic characteristics and their families' social and demographic characteristics to predict parental involvement in the middle of primary school.

Further work will be directed to the secondary analysis of the data and to measuring other relevant parental characteristics.

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