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Original paper

***Criteria for Determining the Alignment  
between the Content of TIMSS Science  
Items and Science and Social Studies  
Teaching Curriculum<sup>2</sup>***

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**Extended summary**

The large-scale international studies employ well-documented and methodologically sound procedures for defining and sampling student populations, developing items, translating items into the different languages of the participating countries, monitoring how students' responses are scored and evaluating aspects of the items' properties. Still, they have attracted a fair amount of criticism regarding their credibility and relevance, with the criticism to a large extent related to issues of alignment between the test items and the national curricula documents. Since the judgments about the efficacy of the national educational systems are made based on the comparison of average national scores, it is important to have clear understanding of what the national educational systems offered to students. If a test is loaded with items that are appropriate for some countries but not for others, it brings into question the fairness of the test for cross-national comparisons.

The paper focuses on the Third International Mathematics and Science Study (TIMSS), an international comparative study of the mathematics and science achievement of fourth- and eighth-graders. In 2011, Serbia participated in fourth grade student assessment, achieving an average national score in science which was slightly above the international mean. Since

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TIMSS focuses on students' curricular knowledge, it could be assumed that the average national scores on TIMSS are affected by the level of correspondence among the item content and the curriculum. Namely, there are differences across countries in the way school science is conceptualised - how topics are grouped together for study at specific grade levels, the sequence of topics studied from grade to grade, and how much emphasis each receives in any one year. The science or sciences that students study in one country can look quite different from what students in another country study.

Given that no test can cover the curriculum in every country completely, the question arises as to how well the items on the tests match the curricula of each of the participating countries. To address this issue, TIMSS asks participating countries to indicate for each item whether it is considered appropriate for their curriculum - Test-Curriculum Matching Analysis (TCMA). The results of TCMA are used to assess the curricular coverage of the items in the tests. However, the criteria for conducting TCMA are not stated in official TIMSS publications.

Therefore, this paper aims to provide criteria which could ensure a reliable classification of TIMSS science items as those covered or not covered in the Science and Social Studies teaching curriculum.

The study utilised the methodology for assessing alignment which, in the first step, entails analysing the content of the Serbian curriculum documents in the field of science and social studies and the released TIMSS 2011 science items for the fourth grade. Based on the content analysis, researchers who are experts in the field formulated the criteria for classification - the first criteria oriented towards topic coverage and the second ones oriented toward the compatibility of item content with the proximity principle. Once the criteria had been produced, the researchers independently applied the criteria to 70 released TIMSS 2011 science items. The produced classifications were discussed among independent researchers and criteria were made until an agreement between the researchers was achieved. The last step involved categorisation of a set of items (6 not covered and 6 covered by the intended curriculum) by an independent expert in order to examine the reliability of the criteria. The agreement between the raters proved to be satisfying ( $K = .667$ ,  $p = .014$ ).

The research shows that topic oriented criteria, both as criteria addressing the proximity principle should be taken into account. For different countries, the level of detail in the specification of the learning goals and contents may vary considerably in official documents. Therefore, the authors do not suggest setting unique criteria for TCMA, but making the process of classification more transparent. Criteria for TCMA should be clearly set and publicly available. Also, in order to ensure the reliability of classification, the process of conducting TCMA should be done in teams.

The appropriateness of items for various countries may also hinge on cultural or geographic issues. For example, students in Serbia may have more advantage in addressing science items about seasonal changes than students from equatorial countries. Therefore, the authors suggest that, for example, animals and plants which fourth-graders in the specific country are familiar with are proposed by country teams in order to ensure a more fair assessment across the participating countries.

**Keywords:** TIMSS, Science, Curriculum, Science and Social Studies.

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