A Standard to Standard Alignment Study between the Brazilian National Education Test (SAEB) and the Curriculum of the State of São Paulo, Brazil, for the Mathematic Content at the 4th Grade/5th Year

Abstract

This paper presents the results of a curriculum alignment study conducted to examine the degree of alignment between São Paulo state curriculum and SAEB reference matrix for the mathematics content at 4th grade/5th year using the content-focus criteria proposed by Webb (1997) and adapted by Cook (2005). As such, the study provides an example of a curriculum alignment to highlight the importance of alignment as an evidence-based test of content validity. This study also illustrates the sensitivity of the structure of the alignment model to issues of data availability. The lack of item availability from the national test was the great influence in the choice of the conceptual framework. The results suggest that the alignment between these two frameworks is very good, especially at the categorical level. However, there are some important differences, as the state’s curriculum seems to cover a wider content range for one of the standards, while SAEB seems to assess students with a higher cognitive expectation for part of the standards.

Keywords: Curriculum alignment. Standard to standard model. State curriculum. ANEB/Prova Brasil: SAEB reference matrix.

Um Estudo do Alinhamento das Expectativas das Matrizes de Referência de Matemática do SAEB e do Currículo do Estado de São Paulo para 4ª Série/5º ano do Ensino Fundamental

Resumo

Este artigo apresenta os resultados de um estudo de alinhamento de currículo conduzido para examinar o grau de alinhamento entre o currículo do estado de São Paulo (SP) e a matriz de referência do Sistema de Avaliação Educação Nacional (SAEB) nos conteúdos de matemática do quinto ano do ensino fundamental, usando critérios metodológicos de foco em conteúdos propostos por Norman Webb (1997) e adaptados por H. G. Cook (2005, 2006). Este estudo fornece um exemplo de um alinhamento de currículo enfatizando a importância do alinhamento para validade do conteúdo do teste. O estudo fornece um exemplo de um alinhamento curricular para destacar a importância do alinhamento para um teste, baseando-se em evidências de validade de conteúdo. Este estudo também exemplifica a sensibilidade da estrutura do modelo de alinhamento para as questões de disponibilidade de dados. Os resultados indicam que o alinhamento entre o currículo e a matriz é muito bom, especialmente no nível categórico. No entanto, há algumas diferenças importantes, o currículo do estado parece incluir uma gama mais ampla de conteúdo para um dos objetivos, enquanto SAEB parece avaliar os estudantes com uma maior expectativa cognitiva para uma parte dos objetivos. Palavras-Chave: Alinhamento curricular. Modelo de expectativas com expectativas. Currículo estadual. ANEB/Prova Brasil: SAEB matriz de referência.
1. **Statement of the Problem**

Educational policies have emphasized the accountability and use of performance measurement as a means of assessing school quality. To obtain success in the tests, schools responded by teaching what is assessed. On the other hand, assessment results are important to provide information to the public, its policymakers, educators, parents, and students themselves about how students are doing. Moreover, to overcome the side effect of schools teaching what is assessed, policy makers have emphasized the implementation of curriculum standards, which would function as a guide, avoiding the risk of schools ignoring desired contents. In the United States, for example, federal government passed the No Child Left Behind Act in 2001 with the assumption that explicit standards for assessing student performance, together with sanctions and incentives for schools meeting specified targets, would improve student learning. (Herman & Webb, 2007).

Brazilian education reform also has focused on outcomes and standard-based tests. The Federal Education Law, Law of Directives and Bases (LDB) 9.394/96, legally introduced large-scale assessment and defined a partnership between the federal government, states, and municipalities in the elaboration of the so called National Plan of Education and the creation of directives regarding kindergarten and basic education. These directives are intended to guide curricula and minimal content standards, ensuring a common basis for public education. Also, the directives and orientation guides provided by the states and districts are used by each school to the school’s curriculum assign to their students.

In this context, assessments need to address the content that was taught in order to be valid tests. Many studies have highlighted the importance of alignment, and the literature has mainly four such models: Achieve model; Surveys of Enacted Curriculum (SEC) model; and Webb model (Council of Chief State School Officers, 2002; Porter, 2002; Rothman, Slattery, Vranek, & Resnick, 2002; Webb, 1997). These documents support the notion that alignment provides a foundation for meaningful reporting of students’ academic progress and “why comprehensively integrating alignment into development processes results in procedural efficiencies and gains in validity evidence for the measurement of student progress” (Martineau, Paek, Keene, & Hirsch, 2007). Other models have appeared in the literature and some of them use the aforementioned methods as a basis, such as Cook, (2005); Flowers, Wakeman, Browder, & Karvonen, (2007).

Alignment makes the test a more valid representation of what students know and can do. In addition, it can help in the identification of gaps between what’s outlined
in the written curriculum, what gets taught and what gets tested indicate that curriculum alignment, in which can be addressed to help students perform better on tests (Webb, 2005; Blank, Porter, and Smithson, 2001). If the test is not aligned with the content received by the students, the students’ performance will tend to be poor. However, if the test is aligned with the content received by the students, then the results will be poor only if the students are unevenly exposed to the mathematics topics in their classrooms (Webb, 2005). The use of alignment of state curriculum as an a priori instrument is justified because it is the guide used by districts and schools to implement their local educational “systems”. For this reason, alignment between the state curriculum framework and the reference matrix used in the test construction will be helpful to provide a better assessment of the real student ability and, therefore, a more reliable educational index.

2. Conceptual Framework and Evaluation Criteria

This study uses a standard-to-standard alignment proposed by Cook’s (2005, 2006) as an adaption of Norman Webb’s alignment process as a conceptual framework. Webb’s document analysis is a process of coding and analyzing the matching among the curriculum standard and the assessment items. The use of Cook’s adapted model helps to overcome the limitation of item accessibility required in the Webb process. In Cook’s adapted model, the emphasis changes from a process of mapping the standards and assessments directly to each other to a process of mapping the state expectation directly to the assessment expectations (Webb, 2007, p. 8).

The alignment is applied to the SP state’s curriculum standards (curriculum framework) and SAEB reference matrix (test framework) documents. Figure 1 provides the criteria of Cook’s (2005) method to the context of this study, that is, what is assessed at 4th grade by SAEB for mathematics content (test framework) should be covered by the state curriculum (curriculum framework used by teachers). Therefore, not all the curriculum objectives are assumed to be assessed. The expectation was that the alignment between SAEB test framework and the SP state curriculum is high, but not vice-versa. In this standards-to-standards model, the state curriculum’s objectives are analyzed as “items” and SAEB test frameworks are analyzed as “standards” when alignment method is applied.
3. Contribution and Purposes

The goal is to foster the educational assessment as an instrument to motivate the improvement of student achievement by establishing criteria and perspectives of curriculum alignment as proposed by Norman Webb (1997) and adapted by Cook (2005, 2006). Also, the aim of this study is to contribute to a judgment of how valid SAEB is regarding its alignment to SP state curriculum at 4th grade. This will contribute to: i) a better understanding of how much SAEB results really reflect what students know and can do; ii) a better understanding of what is tested in SAEB, as compared to what is present in the SP state curriculum standards.

Therefore, the purpose of this study is a) to understand aspects of the curriculum alignment practice as a tool to obtain validation of large scale assessment in the Brazilian context; b) provide content validity evidence, measured as the alignment of the national assessment specifically with the SP state curriculum standards; and c) to contribute to a curriculum alignment study in the Brazilian literature.

4. Alignment Procedure

This study has attempted to follow as closely as possible the alignment study steps proposed by Webb et al. (2005). In order to reproduce the context of a group alignment exercise, two reviewers took part in the alignment process. One was the author of this study, who has instruction on Brazilian 4th-grade education and high knowledge of mathematics, and the other was an economist with limited experience in education, but a high knowledge of mathematics content. The two raters have used SAEB framework
and the state of São Paulo’s curriculum framework as their reference material, as well as a publication by the Ministry of Education (Instituto Nacional de Estudos e Pesquisas Educacionais/DAEB, 1999) which contains explanations and sample questions for each of SAEB objectives (descriptors) and a publication by SP state Education Secretariat (Secretaria de Estado da Educação, 2007) containing a description of learning expectations for math content from the 1st to the 4th grades.

For each of the curriculum objectives and SAEB objectives, the raters independently assigned a DOK level. The coding process used the four levels of knowledge proposed by Norman Webb: (a) recall (b) skill/concept (c) strategic thinking (d) extended thinking. After the assignment of DOK levels, the raters independently matched the curriculum framework objectives with SAEB framework objectives.

Later, the two raters came together to reach a consensus on the DOK levels of all objectives, in accordance with the procedures proposed by Webb. Since there were only two raters, they also reached a consensus over the matching of curriculum and assessment objectives. All the results presented were based on the consensus data..

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5. Findings and Conclusions

The results obtained in this study can guide policy makers in establishing criteria and perspectives of curriculum alignment as an instrument to motivate the improvement of student achievement. In addition, the results can be used by policy makers to improve SAEB validity regarding its alignment to state curricula, so that, by addressing the content that was taught, students can perform better on tests and demonstrate what they know and can do. It should be noted that four of the SP Curriculum objectives C23 (to utilize measures such as cm², m², km² and “alqueires” (=2.42 hectares in the state of São Paulo), C26 (to construct graphics and tables based on information extracted from journalistic, scientific and other texts), C27 (to identify the possible ways to combine elements of a collection and count them with the use of non-tradition calculation techniques [personal strategies]), and C28 (to utilize the notation of probability in simple problem situations) do not matched any of SAEB objectives and one of SAEB objectives (D23. to solve problems utilizing the decimal writing of paper money and coins of the Brazilian monetary system) hasn’t been matched with any of the SP curriculum objectives. Reviewers also made comments on other objectives during the alignment process, pointing out that some of SAEB objectives seem to be covered just partially and, on the another hand, some SP objectives seem to cover more than what is assessed. Attention to construct reliability of the test, in respect to content, is recommended, especially in the cases in which SAEB test seems to cover more than what is taught, since one should expect an assessment to test only what is taught.

In addition, the three alignment criteria, Categorical Concurrence (CC), Depth of Knowledge Consistency (DOK), and Coverage/Breadth, allow for some of the conclusions of this alignment study. All four SAEB standards have a Categorical Concurrence with a strong categorical alignment with the curriculum standards. Secondly, the DOK statistic indicates that two of the four SAEB standards have been classified as having a strong alignment with the SP curriculum framework. The other two have attained a weak alignment, which indicates that SAEB seems to require a higher cognitive level than the one expected from the students in the SP curriculum framework, which could be an area for further alignment research. The coverage statistic also
indicates a significant degree of alignment between three of the four SAEB standards. In the “treatment of information” standard however, SAEB covers a more limited scope of objectives than the SP curriculum.

These results should not be interpreted as a criticism to either the SAEB test framework or SP curriculum standards, but as a tool for possible improvements in both frameworks, if there is a decision, by the policy makers, that these standards should increase their alignment. Improvement can happen by establishing objectives in both instruments in more equivalent cognitive level of expectation. In the SP state curriculum 43% of the objectives have been assigned to level 1, against just 25% of the objectives in the SAEB. Another improvement can happen with a better equivalence of cognitive level concurrence is the validity of SAEB, since SAEB present higher expectation than the SP state curriculum does. It is a drawback to the validity of SAEB test to test higher expectations than what is taught, so an improvement can be obtained by improving the alignment of the D2 (identify similarities and differences among polyhedrons and round objects, relating tridimensional figures with their planar representations) objective which is aligned to three state objectives C13 (to recognize similarities and differences between polyhedrons), C14 (to identify geometric elements such as faces, vertices and sides of polyhedrons) and C16 (to compose and decompose flat figures), and the alignment of D14 (to identify the location of natural number in the numerical ruler) which seems to cover more in depth than what C2 (to recognize and represent rational numbers) covers.

In summary, the alignment between SAEB and the state curriculum in SP is very good, especially at the categorical level. However, there are some important differences in respect to DOK and COV, and further analysis is recommended, especially if new research may be able to access the item levels in order to perform an assessment-to-standards analysis originally proposed by Norman Webb. Other possible extensions would be to include more Brazilian states in the analysis in order to evaluate SAEB alignment with a broader range of Brazilian curricula.

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