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A Graphical Transition Table for Communicating Status and Growth

Adam E. Wyse, Ji Zeng, & Joseph A. Martineau
Michigan Department of Education

This paper introduces a simple and intuitive graphical display for transition table based accountability models that can be used to communicate information about students' status and growth simultaneously. This graphical transition table includes the use of shading to convey year to year transitions and different sized letters for performance categories to depict yearly status. Examples based on Michigan's transition table used on their Michigan Educational Assessment Program (MEAP) assessments are provided to illustrate the utility of the graphical transition table in practical contexts. Additional potential applications of the graphical transition table are also suggested.

The reauthorization of the *Elementary and Secondary Education Act* (ESEA) in 2001 introduced requirements that all students reach proficiency in grades 3 through 8, and one high school grade in math and reading by 2014. In accordance with ESEA, states proposed a variety of plans for reaching one hundred percent proficiency by 2014. All initial plans for demonstrating adequate yearly progress (AYP) were based on the static achievement of successive cohorts of students against proficiency standards established by the state in each grade and content area. These static models, or status models as they are more commonly known, presented numerous challenges.

In response, the United States Department of Education created the Growth Model Pilot Project in 2005 (U.S. Department of Education, 2005, 2006, 2010) with the goal of allowing up to ten states to include growth as some part in their accountability systems. The state response to this program was greater than expected and as of 2009 fifteen states have been approved to include growth as a component in their accountability systems (Dunn & Allen, 2009; U. S. Department of Education, 2010). Under the program, states were allowed to utilize growth models either as an alternative to their status model or as a compliment to it (U.S. Department of Education, 2006, 2010). To date all of the approved states currently incorporate growth as a compliment to the status model.

A variety of growth models were proposed as part of the Growth Model Pilot Project, including models based on transition or value tables (hereafter simply called transition table models), trajectory models, projection models, and conditional growth percentiles (Dunn & Allen, 2009; U. S. Department of Education, 2010). A persistent challenge with these models has been explaining and communicating how the models work to diverse groups of stakeholders. Oftentimes, this group includes individuals with limited training in statistics or psychometrics who may struggle with understanding the models and their components.

The purpose of this paper is to illustrate how a simple graphic can be developed for transition table models, which clearly communicates status and growth information. The goal of the graphic is similar to those of graphics created by Betebenner (2009) for use with conditional growth percentiles, which is to illustrate complex statistical information underlying the models without the use of numbers.

Transition Table Models

Hill (2005) originally proposed transition table models as an alternative to some of the more complex statistically based growth models, such as value-added and regression based growth models. Transition table models are currently used by Delaware, Iowa, and Michigan as part of their accountability systems for calculating AYP.

Transition table models have several notable advantages over other growth models. First, they are typically easier to use and apply than many other approaches because they can be created without the use of special scaling or regression techniques. Second, transition table models avoid the need to create vertical scales that span multiple grades or assume that a single underlying construct is measured over multiple grades, which are often important and sometimes questionable assumptions (Martineau, 2006; Martineau, Wyse, & Zeng, 2010). Instead, the score scale underlying the assessment is broken down into discrete performance categories which are used to track student performance for individual students between adjacent grades and years.

Typically, the number of discrete performance categories is a number of categories that is greater than the number of cut-scores established during standard setting. For example, in Michigan there are twelve categories used in their transition table, but there are only four distinct performance categories established in standard setting. The creation of these additional categories is typically a policy based decision. As part of the policy considerations, states usually consider a variety of factors including features of the underlying score scale, such as the conditional standard error of measurement at and between the cut scores, the underlying distribution of performance and the number and percent of students at each score, the impact of subdividing the category at a specific location on the AYP calculations, stakeholder feedback and input, and the similarity of status and growth designations.

The fact that the categories for the transition table are usually established primarily based on policy considerations leaves open the possibility that it is easier or harder to make different types of transitions across grades or content areas. This implies that there is a dependency on the underlying cut-scores that often interacts with the "growth" calculations that arise from the transition table models. For example, if the cut-score is set low in one grade and high in another grade it may be difficult to make a transition toward being on track toward proficiency in the higher grade. This dependency (and the associated possibility for it to be harder or easier to make different types of transition across grades and content areas) is one of the main criticisms of the transition table models when they are used to calculate growth in accountability systems.

After creating the discrete performance categories, there are several ways of utilizing the categories to calculate numerical results from the transition tables for school accountability purposes. One way of utilizing the information is to assign a number to a student based on the type of transition that they make from one year to the next. Usually, positive numbers are assigned to transitions that are adequate or desirable and zero or negative numbers are assigned to inadequate or undesirable transitions. These numbers are then averaged and compared to a growth target to determine whether or not a school makes AYP. Delaware uses such an approach in their school accountability system.

Another way of using the information is to assign labels to different year to year transitions and to consider certain types of transitions as on track towards proficiency. These students that are on track towards proficiency are counted as proficient due to growth when calculating AYP. Iowa and Michigan both assign labels to the transitions that students make with certain on track transitions counted as proficient for AYP.

In both of these approaches, the key aspects of the growth portion of the transition model are the transitions that the students make and the number and percentage of students that make each type of transition from one year to the next. Students that are on track towards proficiency are either counted as proficient due to growth or assigned a positive value in the transition table. Similarly, for the status components of the model, students that exceed the proficient cut-score in a given year are counted as proficient due to status or assigned a positive value in the transition table. This means that an important part of the status portion of the model is the overall number or percentage of students in each discrete performance category in a given year.

Typical Ways of Showing Information in Transition Tables

To provide an understanding of how transition tables work and the difficulty that can come in communicating information from the models (despite their simplicity in comparison to other growth models used for accountability), a set of concrete examples of the transition table model based on data from the Michigan Education Assessment Program (MEAP) tests are provided. The same principles incorporated in the Michigan example are applicable to other states and contexts in which transition tables are used, although transition tables may be applied slightly differently in each case. Information on the Iowa and Delaware transition table models can be found in USED interim report on growth models published in 2010. The Michigan examples are presented here because data were readily available.

The Michigan transition table model used on their MEAP assessments breaks down performance into twelve distinct performance categories (Martineau, 2007). Three levels are created within each of the four performance standards, not proficient, partially proficient, proficient, and advanced. The three levels within a performance standard are called mini-categories and are labeled high, mid, and low. The mini-categories were created by considering the conditional standard error of measurement at each of the cut-scores and ensuring that the width of the mini-categories between the performance standards were as wide as or wider than the standard error of measurement across the mini-categories (Martineau, 2007). This was done so that movement across categories would exceed measurement error and could be assumed to represent real changes in performance from year to year. The twelve possible performance categories for a student in a given year are: not proficient low, not proficient mid, not proficient high, partially proficient low, partially proficient mid, partially proficient high, proficient low, proficient mid, proficient high, advanced low, advanced mid, and advanced high.

Table 1 displays the basic Michigan transition table for making transitions from one grade to the next. The rows in Table 1 correspond to the twelve performance categories for students' achievement last year for the grade below the current grade of the assessment. The columns correspond to the twelve performance categories for students' achievement at their current grade. For example, to create a transition table for students who took MEAP grade 5 math the performance of all students that took grade 4 MEAP math last year would represent the rows and the performance of all students that took MEAP math in grade 5 this year would represent the columns. The individual cells in the center of the table represent the different types of transitions that a student can make from last year to this year. Data in the center of the table are only for students that have valid scores both last year and this year for a given subject (i.e., matched students).

There are five different types of transitions that students can make in Table 1. The five transitions are: a significant decline if they decrease in performance by more than two mini-categories, a decline if they decrease in performance by one or two mini-categories, a maintain if they obtain the same mini-category in both grades, an improve if they increase in performance by one or two mini-categories, and a significant improve if they increase in performance by more than two mini-categories. The cells above diagonal going from the top left to bottom right corner in Table 1 (with the exception of not proficient low to not proficient mid, not proficient mid to not proficient high, and not proficient high to partially proficient low transitions (i.e., the cells that would not be on track to proficiency if students continued to make the same number of category transitions for three consecutive years)) are counted as proficient due to growth in Michigan's AYP model. All the cells in the rows and columns of the table that are in one of the proficient or advanced categories are counted as proficient due to status. In other states, the cells may be labeled differently and be filled in with values or different labels. For example, in Iowa the cells at or above

Table 1: Michigan Transition Table Example

Grade *X* MEAP Achievement		Grade *X+1* MEAP Achievement											
		Not Proficient			Partially Proficient			Proficient			Advanced		
		Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
Not Proficient	Low	M	I	I	SI	SI	SI	SI	SI	SI	SI	SI	SI
	Mid	D	M	I	I	SI	SI	SI	SI	SI	SI	SI	SI
	High	D	D	M	I	I	SI	SI	SI	SI	SI	SI	SI
Partially Proficient	Low	SD	D	D	M	I	I	SI	SI	SI	SI	SI	SI
	Mid	SD	SD	D	D	M	I	I	SI	SI	SI	SI	SI
	High	SD	SD	SD	D	D	M	I	I	SI	SI	SI	SI
Proficient	Low	SD	SD	SD	SD	D	D	M	I	I	SI	SI	SI
	Mid	SD	SD	SD	SD	SD	D	D	M	I	I	SI	SI
	High	SD	SD	SD	SD	SD	SD	D	D	M	I	I	SI
Advanced	Low	SD	SD	SD	SD	SD	SD	SD	D	D	M	I	I
	Mid	SD	SD	SD	SD	SD	SD	SD	SD	D	D	M	I
	High	SD	SD	SD	SD	SD	SD	SD	SD	SD	D	D	M

Note: SD represents significant decline, D represents decline, M represents maintain, I represents improve, and SI represents significant improve.

the diagonal are labeled on track and the other cells are labeled off track.

When filled in with data, Table 1 is a contingency table much like those in other areas of statistics, although it is somewhat more complicated than a traditional contingency table. This can be seen in Table 2. Table 2 is an example of a filled in transition table for the MEAP math grade 4 in 2007 to MEAP math grade 5 in 2008. The rows show the performance on the fourth grade MEAP math test for 118,468 students with valid scores in 2007 in terms of 12 performance categories. The columns show the performance on the fifth grade MEAP math test for 116,908 students with valid scores in 2008 in terms of 12 performance categories. The individual cells in the center of the table show the performance of the 111,286 students that had valid records in both 2007 and 2008 on the fourth and fifth grade MEAP math tests.

Table 2 differs from a traditional contingency table in that the row and column totals at the margins of the table do not sum to the totals across the rows or columns since the status portions of the model are based on all students that took the tests in a given year, while the "growth" components are based only on students that can be matched between consecutive years. This subtle difference in which status and growth information are based on varying groups of students often may not be fully recognized.

In order to simplify the presentation of information in Table 2, the individual cells in the center of the table and the row and column margins are usually presented as separate tables with the counts in the cells converted to percentages. Typically, some form of shading is also introduced when the information in the center of the table is placed into score reports to show the different types of transitions. The shading is used in this case because including letters to represent the different types of transitions as well as the percentages in each cell can be cluttered and difficult to read. Table 3 shows an example of what the center part of the transition table would look like with the shading and the counts in the cells converted to percentages for the grade 4 to grade 5 transitions in a score report. Table 4 shows an example of how the status information is typically shown in a score report for the grade 5 students.

In Table 3, the cells without shading or with the lightest shading (with the exception of the not proficient low to not proficient mid, not proficient mid to not proficient high, and not proficient high to partially proficient low transitions) are counted as proficient due to growth. The decreasing shades of gray shading from black to white in the background of the cells show the different types of transitions. The black cells are for significant decline and the white cells are for significant improvement. The other shades of gray are the transitions between these two extremes.

There are a few challenges that are apparent in presentation of data from transition table models in these tables. First, although the models are designed to communicate growth, the way that the information is displayed in transition table often does not possess the "growth" interpretations that one wants to attribute to each

Table 2: Transition Table for MEAP Math Grade 4 to Grade 5

Grade 4 MEAP Achievement		Grade 5 MEAP Achievement												
		Not Proficient			Partially Proficient			Proficient			Advanced			Grade 4 Total
		Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High	
Not Proficient	Low	0	0	0	0	1	0	1	0	0	0	0	0	13
	Mid	0	4	26	20	7	7	5	2	3	0	0	0	285
	High	3	71	772	601	262	210	98	52	21	19	16	2	2608
Partially Proficient	Low	0	39	718	777	437	407	193	89	31	36	15	1	3127
	Mid	2	47	819	1019	662	792	396	229	93	64	25	3	4588
	High	3	27	647	1108	899	1181	814	565	193	144	38	4	6103
Proficient	Low	8	25	662	1515	1580	2827	2780	2544	1043	830	201	27	15063
	Mid	6	15	233	669	926	2092	2921	3904	2359	2585	579	59	17227
	High	2	14	94	243	367	1187	2020	4052	3464	5771	2264	264	20685
Advanced	Low	4	9	30	92	119	405	898	2547	3316	9706	8362	2276	28945
	Mid	2	2	8	11	14	42	68	275	529	2886	6143	4581	15084
	High	0	0	1	4	2	7	6	17	27	249	1037	2782	4300
Grade 5 Total		35	302	4482	6630	5687	9773	10725	14988	11590	23114	19305	10277	

cell. For example, one may want to interpret 2.3% in the proficient low grade 4/proficient mid grade 5 cell as meaning that 2.3% of students that were proficient low in grade 4 were proficient mid in grade 5 (in Table 3). This is not the meaning and interpretation of the number in this cell, however. The number simply means that 2.3% of all the matched students were proficient low last year and proficient mid this year. To find the percentage of students that were proficient low in grade 4 that ended up being proficient mid in grade 5 requires that the numbers in the table are used differently. Specifically, each number in a row (as shown in Table 2) needs to be divided by the total for that row for all of the matched students (the row sum for the row in Table 2) and then converted to a percentage.

A second challenge is that the information on transitions and status, because of the complexity in showing the information together, is separated. This requires that individuals who want to understand how the data works together for the purposes of accountability have to somehow integrate the information from separate tables together. This is not a simple task and it can lead to confusion.

A third challenge is that most of the consumers of the information in score reports have limited training in assessment, statistics, and how to interpret data and numbers in score reports. In fact, our experience has been that many educators that we talk with are sometimes afraid of numbers and have a hard time making sense of data in the transition tables and the separate status information. This often results in disregarding one or both sets of information or applying an interpretation to these data that is not correct. It also may mean that an educator is forced to seek out another individual in their school that they trust to try and help them make sense of the data that they receive.

What many educators and stakeholders are looking for is an approach for making sense of the information that involves a picture that they can quickly look at to see what is

Table 3: Example Transition Table for MEAP Math Grade 4 to Grade 5 Expressed as Percentages

Grade 4 MEAP Achievement		Grade 5 MEAP Achievement											
		Not Proficient			Partially Proficient			Proficient			Advanced		
		Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
Not Proficient	Low	0.0	0.0	0.0	0.0	<0.1	0.0	<0.1	0.0	0.0	0.0	0.0	0.0
	Mid	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	0.0	0.0
	High	<0.1	<0.1	0.7	0.5	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Partially Proficient	Low	0.0	<0.1	0.6	0.7	0.4	0.4	0.2	<0.1	<0.1	<0.1	<0.1	<0.1
	Mid	<0.1	<0.1	0.7	0.9	0.6	0.7	0.4	0.2	<0.1	<0.1	<0.1	<0.1
	High	<0.1	<0.1	0.6	1.0	0.8	1.1	0.7	0.5	0.2	0.1	<0.1	<0.1
Proficient	Low	<0.1	<0.1	0.6	1.4	1.4	2.5	2.5	2.3	0.9	0.7	0.2	<0.1
	Mid	<0.1	<0.1	0.2	0.6	0.8	1.9	2.6	3.5	2.1	2.3	0.5	<0.1
	High	<0.1	<0.1	<0.1	0.2	0.3	1.1	1.8	3.6	3.1	5.0	2.0	0.2
Advanced	Low	<0.1	<0.1	<0.1	<0.1	0.1	0.4	0.8	2.3	3.0	8.7	7.5	2.0
	Mid	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.5	2.1	5.5	4.1
	High	0.0	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.9	2.5

Note: 111,286 students were matched successfully.

Table 4: MEAP Grade 5 Math Achievement

Grade 5 MEAP Achievement											
Not Proficient			Partially Proficient			Proficient			Advanced		
Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
<0.1	0.3	3.8	5.7	4.9	8.4	9.2	12.8	9.9	19.8	16.5	8.8

Note: 116,908 students used in calculations.

going on without the use of numbers or with as few numbers as possible. In a recent session on issues in score reporting at the National Council of Measurement in Education, John Hattie (2009) presented a paper in which he discussed and outlined years of research on score reporting. The primary goal of the research was to figure out how educators and stakeholders made sense of score report information and to develop ways to present complex statistical and psychometric information as simply and intuitively as possible. Many of the suggested approaches used colors, shading, and graphics with very few numbers because this is what worked for the consumers of the information. That is the approach we take as we introduce a graphical approach for communicating status and growth information from transition table models in the next section.

Graphical Transition Table

Since the transition table model is essentially based on a contingency table, commonly computed quantities from contingency tables can be used to create graphical output displaying how the transition table models work. The key is to change the number in the separate tables into information that can be used to create a graphic that can be used to simply communicate information to educators and stakeholders.

The "growth" component of the model can be depicted by shading within an individual row of the table based on the marginal row cell percentages. Notice here that the marginal row cell percentages are calculated by dividing frequency count in each cell by the sum for that row for the matched data. This allows one to attach growth interpretations to the data displayed in the graphic. White conveys zero percent of the students that were originally in that performance category in the previous year ending up in the corresponding performance category in the following year. Increasingly darker shades of gray convey greater percentages of students in that row ending up in the corresponding performance mini-category in the following year. The status component of the model in each year can be indicated by the size of the letter for the mini-category displayed on the rows and columns of the transition table. Smaller letters denote a smaller percentage of students in that mini-category and larger letters denote a larger percentage of students in that mini-category.

Figure 1 shows an example of the graphical transition table using the 111,286 matched student records on the 2007 4th grade and 2008 5th grade MEAP math assessments (for letters inside the table). The row and column totals (the letters on the outside of the table) are based on the total number of students in each of those grades in each particular year. The number of these students is 118,468 students in grades 4 and 116,908 in grade 5, respectively. About 43% of the students in both years are economically disadvantaged and 12% of the students are classified as being a student with a disability.

Figure 1 is easy to interpret and explain to stakeholders. For example, the L below Advanced is the largest letter under Grade 5 2008 MEAP math achievement signifying that Advanced Low is the performance level category with the greatest percentage of students in 2008. Similarly, the largest letter under Grade 4 2007 MEAP math achievement is the L below Advanced meaning that Advanced Low also has the greatest percentage of students in 2007. The smallest letters are the L, M, and H under Not Proficient for both grade 4 and 5 signifying that a very small percentage of students are classified into those performance categories in 2007 and 2008. The picture shows that there are a high percentages of students that receive a proficient score or higher in the two years shown in the figure.

Figure 1: Example of Graphical Transition Table for MEAP Math Grade 4 to Grade 5 Transition

2007 Grade 4 MEAP Math Achievement		2008 MEAP Math Achievement: Not Proficient			Partially Proficient			Proficient			Advanced		
		L	M	H	L	M	H	L	M	H	L	M	H
Not Proficient	L	M	I	I	SI	SI	SI	SI	SI	SI	SI	SI	SI
	M	D	M	I	I	SI	SI	SI	SI	SI	SI	SI	SI
	H	D	D	M	I	I	SI	SI	SI	SI	SI	SI	SI
Partially Proficient	L	SD	D	D	M	I	I	SI	SI	SI	SI	SI	SI
	M	SD	SD	D	D	M	I	I	SI	SI	SI	SI	SI
	H	SD	SD	SD	D	D	M	I	I	SI	SI	SI	SI
Proficient	L	SD	SD	SD	SD	D	D	M	I	I	SI	SI	SI
	M	SD	SD	SD	SD	SD	D	D	M	I	I	SI	SI
	H	SD	SD	SD	SD	SD	SD	D	D	M	I	I	SI
Advanced	L	SD	SD	SD	SD	SD	SD	SD	D	D	M	I	I
	M	SD	SD	SD	SD	SD	SD	SD	SD	D	D	M	I
	H	SD	SD	SD	SD	SD	SD	SD	SD	SD	D	D	M

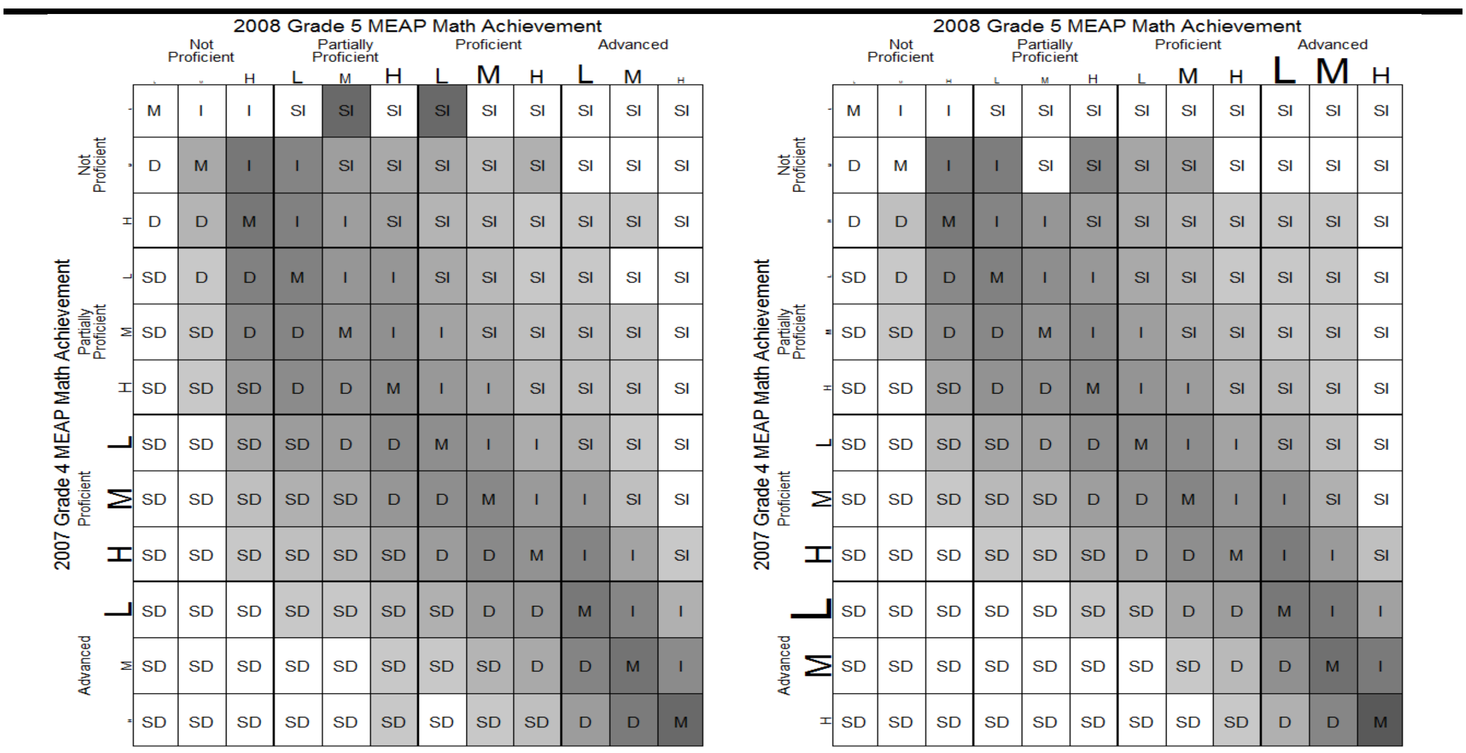
Note: L represents low, M represents mid, H represents high, SD represents significant decline, D represents decline, M represents maintain, I represents improve, and SI represents significant improve.

The shading in the figure, which is read from left to right within each row, clearly shows the patterns of growth on the assessments in the two years. In Figure 1, the darker shades of gray are near the diagonal running from the top left corner to the bottom right corner. This indicates that most students make transitions defined as a decline (D), maintain (M), or improve (I) from 2007 to 2008. Significant improvements and significant declines are less common occurrences since they are very light gray or white. No students are found in the cells in the bottom left or top right corners, suggesting that at least for the two years under investigation, no students declined from an advanced mini-category to a not proficient one or increased from the not proficient low or mid category to an advanced mini-category. An encouraging result is that the few students that were in the not proficient low mini-category in 2007 all significantly improved in performance.

These types of graphs are easy to understand and create to address a lot of the common questions policymakers and educators typically have related to growth models. Common questions we have heard revolve around whether students in various subgroups grow at different rates and whether status based approaches that use proficiency cut scores are the best mechanism for measuring students (Ho, 2008). For example, there are often policy questions about whether students with disabilities and students that are economically disadvantaged grow at the same rate as students without disabilities and students who are not economically disadvantaged. These groups of students tend to have lower status achievement and it is often argued that growth models may be better for accountability to the extent that they are able to reward schools that are helping these students with low achievement improve (Ho, 2008).

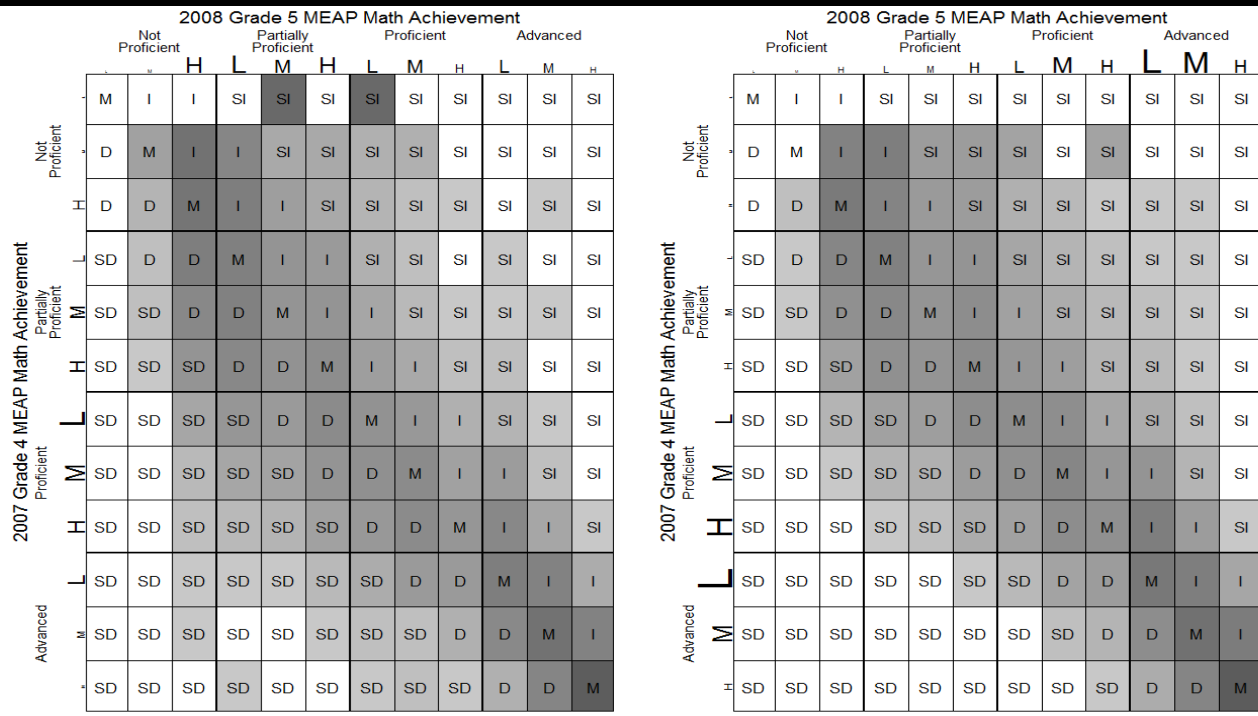
Figures 2 and 3 provide two sets of transition tables that show these descriptive comparisons for the grade 4 and grade 5 transitions on MEAP math for these subgroups. Figure 2 shows the economically disadvantaged students versus non-economically disadvantaged students and Figure 3 shows students with disabilities versus students without disabilities. Several things are apparent from the two figures. First and not unexpectedly, the economically disadvantaged students perform worse than non-economically disadvantaged students and students with disabilities perform worse than students without disabilities in terms of status level achievement. This can be seen by examining the letter sizes in the two pictures and realizing that the bigger letters are found at lower achievement levels for students with disabilities and economically disadvantaged students. Second, many economically disadvantaged students and students with disabilities still make transitions running mainly along the diagonal of the table, but the economically disadvantaged students and students with disabilities appear to be growing at slower rates for these data. This can be seen in the greater amount of darker shading in the significant decline and decline cells and less and lighter shading in the improve and significantly improve cells in comparison to their counterparts. This suggests at least for data shown here that these students have lower status level

Figure 2: Graphical Transition Tables for Economically Disadvantaged and Non-Economically Disadvantaged



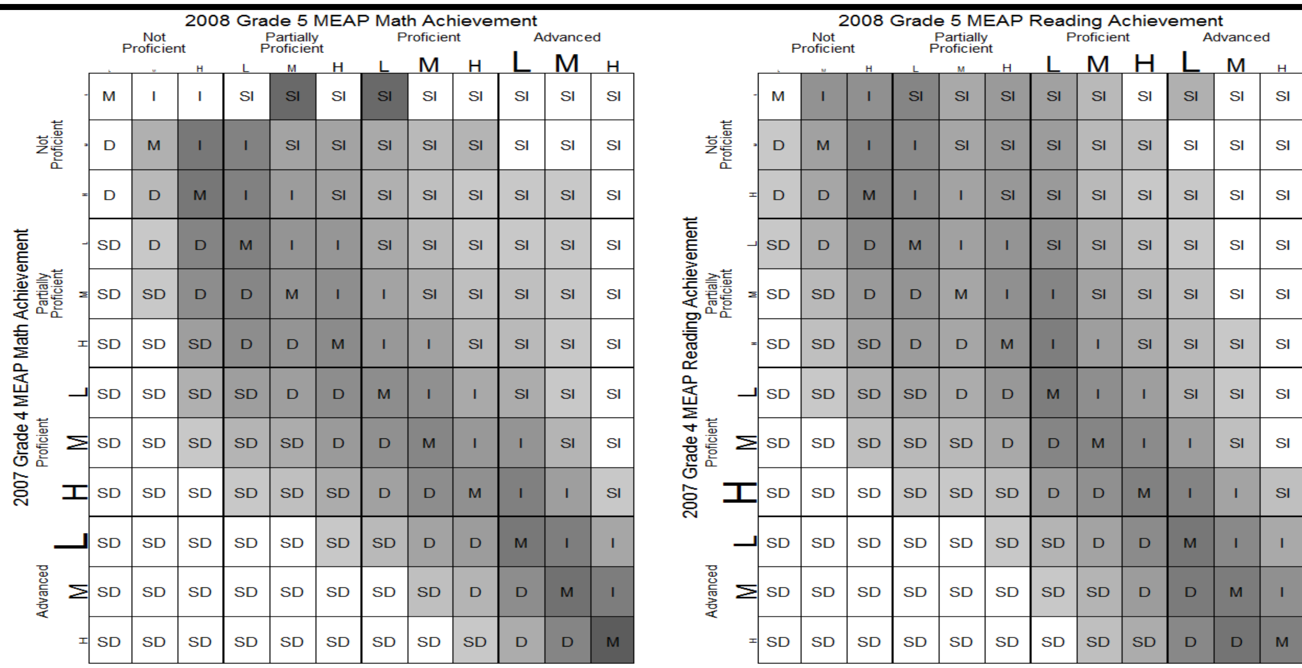
Note: Economically disadvantaged students are in the left panel and Non-Economically Disadvantaged students are in the right panel.

Figure 3: Graphical Transition Table for Students with Disabilities versus Students without Disabilities



Note: Students with disabilities are in the left panel and Students without Disabilities are in the right panel.

Figure 4: Graphical Transition Tables for Grade 4 to Grade 5 Transition for Math and Reading



Note: Math transitions are in the left panel and Reading transitions are in the right panel.

achievement and that they appear to be growing at slower rates. There are some students that are making encouraging transitions, including a small number of students with disabilities and economically disadvantaged students who were in the lowest performance categories that significantly improved. These students would not have been counted as proficient without the growth model.

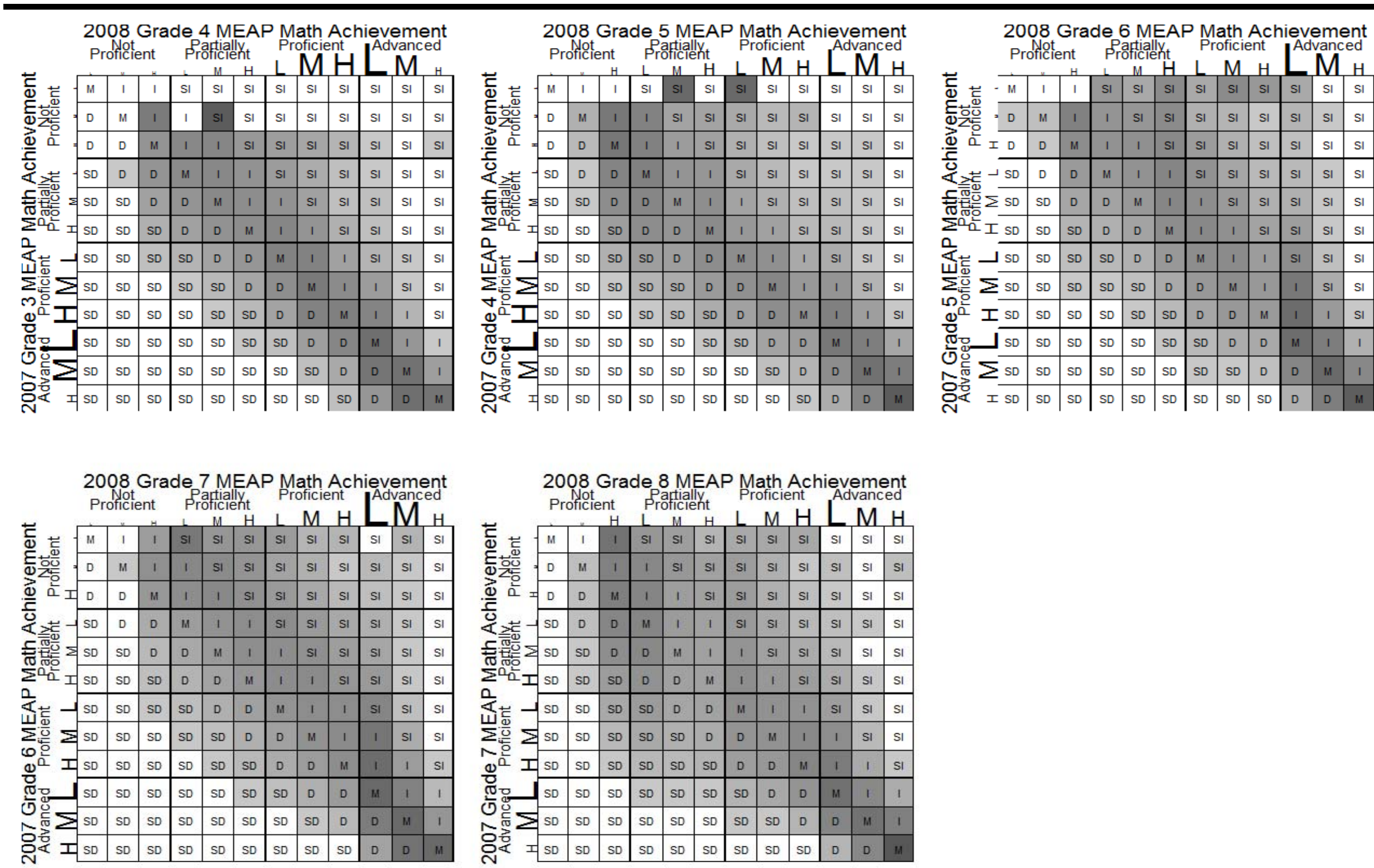
Comparisons can also be made across grades and content areas using graphical transition tables. Figure 4 shows the grade 4 to grade 5 math transition table together with the reading transition table. In examining these graphical transition tables, it is clear that status level achievement in both grades tends to be slightly higher in math than in reading, although a lot of students tend to be classified as proficient in both subject areas. In terms of growth, there tends to be a greater spread in terms of the range of transitions that students can make in reading compared to math. This can be seen with the wider range of cells with moderate amounts gray shading. Figure 4 also shows that there is greater variety of significant improvements for students that start out in the not proficient mini-categories in reading compared to math as can be seen with the greater number of cells with darker gray shading in reading. This is an encouraging finding.

Lastly, Figure 5 shows the graphical transition tables across all the grade to grade (from grade 3 to 8) transitions from 2007 to 2008 for math. The tables suggest that in general the status level proficiency rates in each of the grades tend to be fairly similar; most of the students are in one of the advanced or proficient mini-categories. There are some slight differences in growth patterns across grades, but by and large the greatest concentration of students score along the diagonal in the maintain, improve, or decline cells. Few students tend to make significant declines and significant improvements. There does appear to be more variety and spread in terms of the growth that students make in middle school transitions compared to those in elementary school as can be seen with fewer really dark gray shades on the diagonal and a greater range of gray shades off the diagonal.

Conclusion

Coming up with simple methods and approaches for communicating information from complex accountability models is a pressing need in the field of education. Oftentimes, the models are not fully understood by the people ultimately impacted by the models. This is particularly the case with many of the current growth models that are applied in state testing programs. This paper makes an important contribution by providing a simple and intuitive graphical display that can be utilized by states

Figure 5: Graphical Transition Tables for Transition across Consecutive Grades in Math



employing transition table models to help in communicating the functioning of the model. The approach uses shading to convey grade to grade growth transitions and different letter sizes to show status level information underlying the model.

Although the approach is simplistic and seems easy to interpret by educators and those with non-technical training, additional research is needed to determine whether or not educators and stakeholders interpret the pictures in the way that they are designed. We have found in informal conversations with educators where we have shown them the graphics with simple explanations that they find the graphical approach easy to understand and that it makes sense to them. However, it is possible that other educators may struggle to understand some components of the graphics. In particular, it may be that seeing information on both status and growth in one place may be challenging for some consumers of score reports. Additional research in the form of focus groups, formal surveys, and questionnaires would be helpful to understand how educators interpret these and other approaches for communicating growth. To date a very limited amount of research has been conducted in understanding how educators comprehend information in score reports. Research by Hattie (2009) is a notable exception. However, Hattie's research has not specifically focused on understanding growth information like that in the transition tables, value-added models, or conditional growth percentiles.

It is also important to point out that those with statistical training may find a simple graphic designed to communicate in a descriptive way less than satisfying. As a group, people with this type of training are versed in seeing numbers and data, which they can use for a variety of different purposes. This includes testing hypotheses, making formal statistical comparisons, inputting these data into other models, etc. The point of creating the graphics is not to eliminate the presence or availability of these numerical data to those that may find these data of interest, but rather to present an approach for communicating important information that those without formal statistical training can understand and use. We think that these types of approaches are important because most of the people that are consumers of information in score reports have no or very limited statistical or assessment training and often have particular challenges in making sense of numerical data.

Future research could also explore how to present both graphical transition tables and numerical data in score reports to appeal to both audiences. This may be possible by having separate pages of score reports developed to show both graphical transition tables and contingency tables with numerical data.

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Corresponding author:

Adam E. Wyse
Psychometrician for Alternate Assessments
Michigan Department of Education
Office of Psychometrics, Assessment, Research & Accountability
Bureau of Assessment and Accountability
WyseA [at] michigan.gov