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Letter

Assessing the impact of culture-based education

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I have over the past several years been involved with Hawai'i's Kamehameha Schools on a project called the Hawaiian Cultural Influences in Education (HCIE) study. Kamehameha Schools was established to provide educational opportunities to improve the capability and well being of people of Hawaiian ancestry.

I am using this letter to describe some of the more interesting findings from this line of work so far. Central to this work is the evaluation of effects on student achievement attributable to exposure to a Culture-Based Education (CBE) curriculum. I'll describe CBE more completely in a subsequent section.

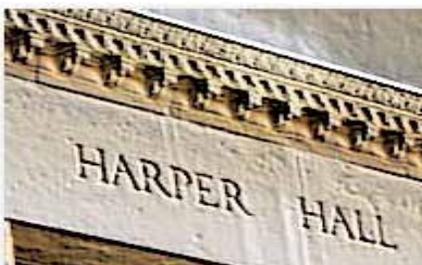
Two key questions guide the development of the HCIE effort:

1. How do culture-based educational strategies affect the achievement and growth of students?
2. What factors mediate the relationship between culture-based education and student achievement/behavior (e.g., self-esteem, student engagement, cultural identity, family/community connections)?

We use a wide range of survey data collected from teachers, students, and parents to examine the questions above. We also use data from administrative records on students enrolled in the schools participating in the study. We focus specifically on student performance in math and reading as our outcomes.



Culture-based educational (CBE) strategies are viewed as a promising approach to address disparities between indigenous students and their peers (Ledward & Takayama, 2008). CBE represents an indigenous conceptual framework defined by five primary domains. These domains emphasize 1)



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a focus on culturally-relevant content, 2) culturally relevant contexts, 3) the use of heritage language, 4) the involvement of family and community, and 5) indigenous forms of assessment.

My colleague Ron Heck (University of Hawai'i at Manoa) and I are examining the impact of CBE strategies in a multilevel educational context where students are nested in classrooms and schools, each with its own environmental features that shape teacher and student attitudes and behaviors.

Before I get into the nested nature of relationships presumed to affect learning outcomes (these are expressed in our guiding question 2), let me introduce the more basic correlational relationship expressed in guiding question 1 that underlies this work.

The central idea in this question is captured with the widely used conceptual model in Figure 1 below. Basically, this figure suggests that CBE has a direct effect on learning outcomes (as expressed through academic performance) and an indirect effect on these outcomes that operates through enhanced socio-emotional development.

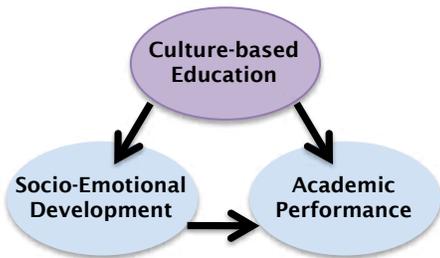
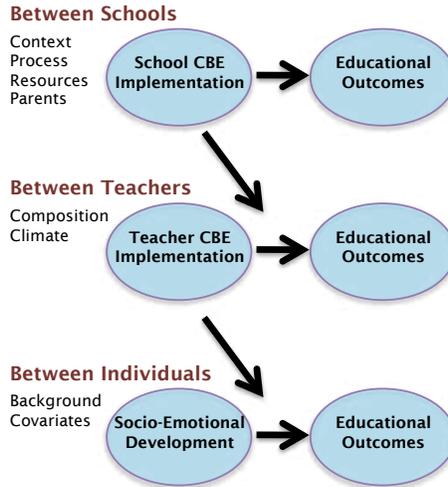


Figure 1. Relating CBE to Learning

Our guiding question 2 is more complex and is illustrated in Figure 2. It assumes a relationship between student achievement/behavior (as expressed in Figure 1 above) and focuses on why that relationship may be stronger or weaker for some students relative to others. Any number of factors could moderate this relationship. They might be student-level factors such as ethnic background or socioeconomic status, teacher characteristics such as time in the classroom, gender, or ethnicity, or school-level factors such as school size, average teacher “quality,” or the

demographic composition of the school. There is also a parent/family component that might play a role in this relationship.

Figure 2: Proposed Multilevel Model



The figure implies several relationships that we test using data from a sample of middle and high schools in Hawai'i. Our effort here capitalizes on a body of methodological work that Ron and I have been deeply involved with over the past decade (Heck & Thomas, 2000; Heck, Thomas, & Tabata, 2010; Heck, Thomas, & Tabata, forthcoming). This methodological work is focused on better capturing the interactions between individuals and the contexts in which they are nested. That is, we are interested in examining how contexts can shape behaviors and learning outcomes. We use a range of multilevel models to operationalize the conceptual model in Figure 2.

How do we measure these things?

We include a CBE teaching rubric on the teacher survey. This rubric measures critical indicators in the five domains with Likert-type scales. Each domain is described in behavioral terms to indicate different levels of implementation (Ledward & Takayama, 2008). Our statistical models suggest that CBE as a construct is well measured by the items included on the teacher survey.

We measure student affect using items operationalizing the socio-emotional development construct in Figure 1. These items are incorporated on the student survey and include questions about self-efficacy, cultural

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affiliation, cultural knowledge and practice, connection to 'ohana (family), and connection to the community. As with the CBE construct, we find that the socio-emotional (SE) construct is also well measured by the range of variables included on the student survey. We were also able to establish that student socio-emotional development affects achievement outcomes that we are interested in. Thus our results are consistent with and supportive of the model depicted in Figure 1.

A three-level model

While I'll avoid the details of the statistical models here, I'll state simply that our results are based on a series of three-level analyses of achievement using data from 1,055 students cross-classified with 245 teachers, in 43 Hawai'i schools. This approach allows us to decompose the variance in achievement across the three levels and to associate those variances with explanatory factors at each level (e.g., teachers, students, or schools). Moreover, we can also test for effects resulting from interactions across the levels. For example, we might want to estimate the effect of the school environment on teachers' impact on student development and achievement. This is a relationship implicit in Figure 2.

What are the major findings?

Finding #1: Teacher implementation of CBE is contingent on "average" school CBE implementation. Our results show us that, in math, teacher implementation of CBE is contingent on the average level of CBE implementation in the school; this supports the type of "cross-classified" relationship proposed in Figure 2 (i.e., see the vertical arrow between schools and classrooms). More specifically, we find that the effect of individual teacher use of CBE principles at the classroom level is moderated by the average school implementation of CBE. In reading, average teacher CBE implementation is also significantly related to reading levels. Moreover, this effect is once again contingent on the average implementation of CBE at the school level. In other words, the findings support the notion that school implementation of CBE forms a context for this type of instruction that positively affects student learning. Through our

analysis we find that in reading, the percentage of fully qualified teachers in the school also interacts with teacher implementation of CBE in the classroom. Our results provide support for the idea that individual teacher commitment to CBE matters (that is, it is positively associated with student performance in reading), but that the broader school environment powerfully moderates their impact on student performance. In math, we note teacher implementation of CBE at the classroom level enhanced the effect of student socio-emotional development on achievement. This provides evidence of another cross-level effect proposed in Figure 2. In follow-up analyses we also find that teachers who are "high implementers" of CBE have a particularly strong positive (and significant) effect on student learning in math.

Finding #2: Parent perception of student socio-emotional growth is an important predictor of student and school achievement. In a separate analysis we focus on parent perceptions measured at the individual student and school levels and their impact on student learning. Our results suggest a positive relationship at both levels, controlling for school composition (and average teacher quality).

We next add parent perceptions to CBE implementation. The analyses adding the parent variables are based on a subset of the data.

Our results are consistent with the idea that parent support at the school level is an important predictor of student achievement outcomes. Our findings suggest the positive impact of parent perceptions of their children's socio-emotional development on achievement at the school level. Once again, we find that CBE impact in the classroom on achievement in reading and math is contingent on average CBE implementation at the school level. In this area we also find that individual parent perceptions of their child's socio-emotional development enhanced achievement in math (but not reading).

Finding #3: CBE enhanced the effect of student socio-emotional development on math achievement. Our analysis also

suggests that teacher implementation to CBE principles enhanced the effect of student socio-emotional development on math achievement. This finding does not hold in reading, however.

Discussion

Overall the results provide considerable support for the proposed three-level model of individual, classroom, and school influences on student learning. The models take advantage of considerable student, teacher, and school data. First, at the student level, the results confirm that aspects of students' backgrounds exercise some influence on their achievement (e.g., gender, socioeconomic status, race/ethnicity). These factors have been well established in previous research. Similarly, previous achievement (e.g., in either reading or math), as we might expect, contributes to later levels of achievement in both of those areas.

In math, the student affect variable is positively related to outcomes. Recall that this is a composite indicator comprised of variables tapping self-efficacy, cultural affiliation, cultural knowledge & practice, connection to 'ohana, and connection to community. Also, higher levels of teacher CBE implementation increased the relationship between student affect and achievement in math.

In reading, however, we could find no relationship. We think this may be an anomaly as our more detailed follow-up analyses with students from a subset of schools with high proportions of students of Native Hawaiian ancestry showed that student affect is significant and positive in explaining both reading and math outcomes. We also find that parent support is positively related to both student achievement outcomes. This provides support for the idea that the parent variables (at the individual-student level) contribute meaningfully to explaining individual-student outcomes.

Second, at the classroom/teacher level, the focus is primarily on teacher implementation of CBE. The findings add something new in terms of demonstrating the added

value of school CBE in moderating the relationship between individual teachers' implementation of CBE and student achievement. We noted that the individual teacher effect in this area seems to be related to the school's average implementation of CBE. In both the reading and math models, stronger CBE average implementation at the school level is related to a stronger effect of individual teacher implementation.

This provides support for a key cross-level relationship (i.e., a vertical arrow in Figure 2) implied within the multilevel conceptual framework. Central to a multilevel framework is the fact that conditions at higher levels of the data hierarchy are assumed to directly influence relationships at lower levels. These cross-level interactions provide important means through which strategic actions at the school level can have "coordinating" effects on relationships at classroom levels. In a number of preliminary (e.g., two-level) analyses, we also find that teacher demographics (e.g., gender, education, experience, years in Hawai'i, Hawaiian studies major, Hawaiian language course) have no direct impact on student learning at the classroom level. The aggregated parent variable (as a classroom composition indicator) also is not directly related to student achievement at the classroom level.

Our intermediate analyses of the composites also reveal that each separate indicator of CBE is significantly related to the student affect composite. This suggests each of the indicators is useful in defining CBE. The student affect indicators, however, work best as a composite. In our intermediate analyses of that measure, we find self-efficacy and 'ohana alone to be related to the composite CBE measure; however, the other indicators separately are not related to teacher CBE.

Third, at the school level, two variables have consistent influence on differences in school outcomes. The first is the percentage of fully qualified teachers in each school. Schools having higher percentages of fully qualified teachers have higher outcomes in both reading and math. The second is average parent support (aggregated from the

student level), which is positively related to outcomes in reading and math at the school level. This provides further evidence of the importance of this variable, in that it works as a type of composition effect (i.e., it demonstrates that effects of parent support tend to accumulate across levels of the data hierarchy).

Taken together, the results of our multilevel analyses suggest that CBE is an important predictor of achievement, contingent on the school's overall level of implementation of these principles. We note that the three major constructs at the center of this research (i.e., teacher CBE, student affect, and achievement) seem to work in expected ways. More specifically, our results provide evidence that teacher CBE (at either the school or teacher level) is related to both student affect and achievement. This lends validity to the instruments through which they were defined and measured, as well as their observed effects within our proposed conceptual model to explain student learning outcomes. Similarly, in most instances, the student affect measures we used are positively related to achievement—more definitively in math, but also in some subsets of the data on reading outcomes. These findings are quite consistent across the various models we have specified.

Limitations

Two primary limitations should be noted in considering the results of our analyses at this point. First, questions remain about the definition of teacher CBE implementation in the classroom. Differences in preparation, instructional strategies, learning activities, and social contexts are likely embedded in the concept of effective implementation and delivery of principles contained in the CBE construct. It is also unclear from the present data what the actual mechanisms are that link differences in the quality of schools' implementation of CBE, the quality and stability of their teaching staffs, and the collective effectiveness of CBE implementation on the implementation of CBE by individual teachers (especially how students' exposure to different combinations of teachers may influence affect and academic performance). As a classroom-

level measure, teacher implementation of CBE (as a set of survey items) leaves unanswered questions about how the effectiveness of CBE implementation might result from differences in teachers' expectations, curriculum coverage, and domain-specific learning activities (as well as how school implementation might contribute). Similarly, as a school-level variable, collective teacher CBE implementation is only a proxy for more thorough information that could be aggregated about teachers' expertise and professional learning. Although upgrading teacher CBE skills represents a promising avenue for school improvement, we still need to identify key pedagogical strategies and behaviors in each subject domain that enable more effective teachers (in terms of CBE usage) to foster students' academic growth in diverse school settings. This might be enhanced by up-close classroom measures (e.g., logs, observations) of teachers' teaching plans, assessments of their lesson performance, assignments and feedback for students, and so forth.

A second limitation is embedded in the rudimentary way we begin to address questions about temporal sequences underlying associations between teachers and student outcomes. Although our analyses include a measure of student achievement at time 1, the measures regarding implementation of CBE are only collected on one occasion. This has been a limitation of previous cross-sectional research on teacher effectiveness (Goldhaber, 2002; McCaffrey et al., 2003; Seidel & Shavelson, 2007). This approach is limited in that it begs the question, "do the observed results represent a difference in the quality of teachers' skills and implementation or some type of a selection effect?" It is possible, however, that over time more highly-qualified (and effective) teachers seek schools with particular student composition or where educational processes and student outcomes are stronger.

Despite these two limitations, the results offer some promising avenues for policy development and further research. The results and limitations of this study suggest that work on teacher

implementation of CBE should proceed in at least 3 directions.

1. There is a need to provide clear linkages between teachers' professional preparation, qualification, and professional development in terms of implementing CBE. This in turn needs to be connected to their expertise in domain-specific teaching activities, and classroom effectiveness. This will likely occur with increased facility to link students and their teachers within educational accountability systems.
2. The accurate and valid measurement of how the differential effectiveness of several teachers in terms of CBE skills contributes to students' learning growth across a variety of classroom contexts remains a fruitful area of inquiry. This is especially important in policy debates about the nature and features of evaluation systems

that hold teachers accountable for students' progress. Future research might examine whether school conditions moderate the size of classroom/teacher effects described in our work. This can be accomplished through larger unit samples that will allow more complete specification of the conceptual model.

3. Finally, combining detailed information about what teachers do in classrooms to facilitate learning and what school leaders can do to build the school's professional capacity should contribute to a more complete understanding about how teacher skills and effectiveness, as school resources, affect student learning under a variety of classroom and school conditions.

Our work on these fronts continues and I will report on our progress in a future letter.



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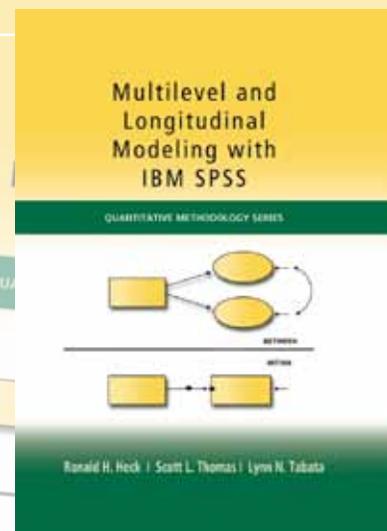
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MULTILEVEL AND LONGITUDINAL MODELING WITH IBM SPSS

This is the first book to demonstrate how to use the multilevel and longitudinal modeling techniques available in IBM SPSS Version 18. The authors tap the power of SPSS's Mixed Models routine to provide an elegant and accessible approach to these models. Annotated screen shots with key output provide a step-by-step understanding of each technique. Diagnostic tools, data management issues, and related graphics are introduced throughout. SPSS commands show the flow of the menu structure and how to facilitate model building. Annotated syntax is also available for those who prefer this approach. Most chapters feature an extended example illustrating the logic of model development that demonstrates the context and rationale of the research questions and the steps around which the analyses are structured.

The book opens with the conceptual and methodological issues associated with multilevel and longitudinal modeling, followed by a discussion of SPSS data management techniques which facilitate working with multilevel, longitudinal, and/or cross-classified data sets. The next few chapters introduce the basics of multilevel modeling, how to develop a multilevel model, and trouble-shooting techniques for common programming and modeling problems along with potential solutions. Models for investigating individual and organizational change are developed in chapters 5 and 6, followed by models with multivariate outcomes in chapter 7. Chapter 8 illustrates SPSS's facility for examining models with cross-classified data structures. The book concludes with ideas on expanding the various multilevel and longitudinal modeling techniques introduced and issues to keep in mind in conducting multilevel analyses. Ideal as a supplementary text for graduate level courses on multilevel, longitudinal, latent variable modeling, multivariate statistics, and/or advanced quantitative techniques taught in departments of psychology, business, education, health, and sociology, this book's practical approach will also appeal to researchers in these fields. The book provides an excellent supplement to Heck & Thomas's *An Introduction to Multilevel Modeling Techniques*, 2nd Edition; however, it can also be used with any multilevel and/or longitudinal modeling book or as a stand-alone text.



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Dr. Scott L. Thomas is professor of education at the School of Educational Studies. He earned a Ph.D. from the University of California, Santa Barbara in 1994 and has held academic positions at the University of Georgia, the University of Arizona, and the University of Hawaii.

Thomas' substantive work bridges K-12 and higher education and focuses on issues related to the stratification of educational experiences and opportunities. Topics revolving around college access and success are central themes in his research and teaching. This work can be found in a range of refereed journals, monographs, reports, and book chapters.

In addition to his substantive work, Thomas has devoted a considerable amount of effort to research on methodological issues. As much of his substantive work concerns the structural influences on individual behavior and opportunity, the development and explication of statistical methods capable of modeling such phenomena have also attracted his interest. His work in this area can be found in books, *An Introduction to Multilevel Modeling* (with Ron Heck) or *Multilevel and Longitudinal Modeling with PASW (SPSS)* (with Ron Heck and Lynn Tabata), and related articles in a number of refereed journals and book chapters.

Thomas is the editor of the *Journal of Higher Education*, one of the field's top journals. He has served as guest editor for the *American Education Research Journal* and is a co-editor of the *International Studies in Higher Education* series. He is a regular reviewer for several discipline specific journals and currently serves on the editorial board of the journal *Research in Higher Education*, the annual *Higher Education: Handbook of Theory and Research*, and on the *Reading on Equal Education* advisory panel.

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