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## **Mending the Gaps in the Science Curriculum**

### **Vexation**

There are no shortages of vexations for science educators focused on reform. The current state of practices and policies in the U.S. public education system produces, at the completion of the K-12 experience, a citizen that in general lacks deep knowledge and understanding of the tools (e.g., mathematics), concepts, and content that define science literacy. I believe that this failure is a function of many different factors that lead to incomplete, fragmented learning that overall lacks context. Some of the more commonly cited factors include: the “inch deep - mile wide” phenomenon wherein too many benchmarks are presented in too shallow a fashion; inadequate pre-service and in-service teacher training in the appropriate content areas; and the minimization of integrated learning across curricula. My personal vexation relates to an element that is less often recognized. I suggest that a breakdown in the scope and sequence of standards-based learning occurs on a regular basis as a result of inadequate communication among teachers within and between grade levels. Consequently, gaps in standards-aligned curricula are unnecessarily created that could potentially undermine future learning.

*National Science Education Standards* reformers as well as proponents of high stakes testing both recognize the need for the coordination and development of K-12 science programs across grade levels. In reality, teachers individually select which strands and benchmarks (Florida’s standard terms for content areas and learning outcomes respectively) are emphasized during the school year as well as many of the instructional resources they utilize. As a result, certain areas of content and process are taught in a more cursory fashion than others. The danger arises when students encounter teachers that underemphasize the same body of information for extended portions of their academic career. There are many components of scientific knowledge and understanding that require significant scaffolding of concepts that must be developed over the course of many years of learning. For such scaffolding to occur in a cogent fashion, it is imperative that teachers across grade levels develop a functional understanding of what abilities and skills students must ultimately master. Teachers must also be aware of their instructional role in this overall development. In an educational system where teachers often work in relative isolation this becomes a difficult perspective to attain.

The negative effects of the lack of communication between grade levels can manifest itself in many ways ranging from the gross under-emphasis of certain science content standards to the unnecessary rehashing of skills and standards that have previously been taught more thoroughly. While it goes without saying that teachers must recognize effective curricula, they must also recognize how the curricula effectively fit in the overall academic experience to engender science literacy. This requires a working understanding of the grade level expectations of specific science standards as well as a comprehension of the overall scope of the standards themselves. In my experience as a professional developer, I regularly encounter K-12 faculty and administrators who in theory recognize these important elements but fail to facilitate inter-grade communication or engage in formal activities designed to address these needs. Time is the commodity in the classroom and only with a coherent plan designed to address the scope and sequence of learning across grade levels can we maximize the learning opportunities.

## **Mending the Gaps in the Science Curriculum**

### **Venture**

Clearly, ventures by nature are daring and to propose only one solution to any vexation is both unwise and unrealistic. To repair holes in science curricula that are created due to lack of coordinated planning and to suggest that we should simply encourage educators to come to a consensus regarding multi-grade curricular design and implementation at the school-wide level is naïve. In the American Education System today change must occur by design of the teachers - this means that they have to move out of their classrooms and grade-level isolation and engage in dialogue. Teachers must participate in activities that lead *them* to the identification of these critical curricular gaps and promote *their* discussions of strategies and possible solutions. I propose that these activities, guided by both university and district staff, become a regular part of pre and post planning at the elementary-, middle-, and high-school levels.

One possible component to the solution is professional development designed to engage teachers and administrators in activities that link current curriculum to the *National Science Education Standards* and/or state standards that they address with an emphasis on inter/intra grade level continuity. Training will include how to identify and correlate standards to curricula, and how to recognize the relative role of grade level expectations. Together, educators will generate an explicit map of how curricula across grades should work together as well as select any necessary supplemental curricula. These activities are especially pertinent for schools systems that are adopting new standards or reassessing existing standards in the wake of high-stakes standardized testing of science content and processes.

On the collegiate level pre-service teachers must also be made aware of the potential pitfalls associated with planning in isolation. Student teachers must recognize that only through collaborative preparation at the faculty wide level can subtle gaps in curricula composition be identified and repaired.

Peer driven professional development, specifically “Lesson Study”, could also aid in facilitating the communication necessary for resolving this dilemma. By its very nature, lesson study brings classroom teaching out of the isolation so common for American classrooms. One of the primary intents of lesson study is to focus group attention on overarching goals that can only be realized through the sustained coordinated efforts of many teachers in all grades. By identifying gaps and needless redundancies such ventures would greatly aid in creating a scope and sequence that more effectively provides standards based science learning across the K-12 educational experience.