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Daniel R. Suiter

Optimizing Pest Management Curricula for Use in K-12 Classrooms

Makena Mason, Maria Aihara-Sasaki and J. Kenneth Grace
Department of Plant and Environmental Protection Sciences,
College of Tropical Agriculture & Human Resources,
University of Hawaii at Manoa, Honolulu, HI

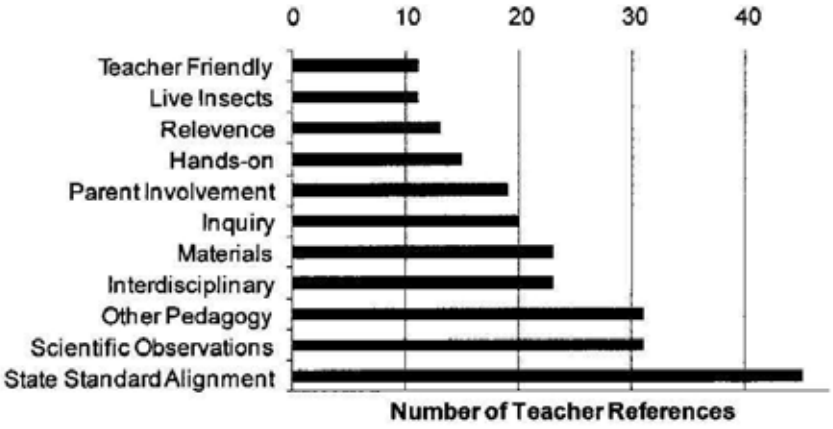
"Educate to Eradicate" is a K-12 curriculum project using termite biology and control as the basis for science education (Grace et al. 2007, 2008) that has been implemented in over 350 Hawaii public school classrooms with more than 11,800 students; and is coupled with community outreach efforts. This study was initiated to (1) identify factors that influence the adoption and continuation of pest management curricula in public school classrooms, and (2) evaluate the efficacy of community education efforts. Teacher focus groups were organized to assess “Educate to Eradicate” curriculum design and professional development implementation. Perceptions of key project components and supports were recorded during teacher focus groups. Project supports useful for continued curriculum implementation were summarized and rated. Secondly, we evaluated changes in instructional practice and student learning. Efficacy of the program in promoting termite suppression was measured through student engagement in extension activities and changes in prevention knowledge. Findings will inform modifications to curriculum, professional development, and project supports. Resources will be optimized to maximize teacher continuation and student learning.

Partner teachers during the 2011-2012 school year were recruited to participate in focus groups (n=22, 41%). Five homogeneous groups were organized based on grade level, years of partnership (early adopters ≥ 3 years, late adopters ≤ 2 years), and school location (Morgan 1997). All groups were recorded, transcribed, and analyzed using content analysis (NVivo qualitative data analysis software; QSR International Pty Ltd. Version 9, 2012). The study design, procedures, and instruments were approved by University of Hawaii Institutional Review Board (CHS#18356).

Keys to Project Success

Focus group participants identified essential aspects of curriculum design, training, and support. Overall, the curricula’s alignment to Hawaii state standards, incorporation of scientific observation, and use of pedagogy (reinforcement, kinesthetic songs, and crafts) were most frequently cited as motivators. Additionally, use of live organisms, hands-on activities, visuals, inquiry activities, and parent involvement were described as keys to project success (Figure 1).

Figure 1. Perceptions of Curriculum Design, Emergent motivators for adoption from teacher focus groups analyzed with NVivo 9.



In addition to curriculum design, teachers reflected on the project's professional development. Educate to Eradicate has employed a range of professional development techniques throughout its lifetime. Early-adopting elementary teachers felt their weekend training went beyond what they could utilize in class, however they enjoyed mastering content and conducting inquiry laboratories. Birman et al. (2000) argue that professional development that focuses on science content while providing opportunities for active learning positively affects teacher adoption (2000). Late-adopting elementary teachers valued in-class lesson modeling, which did not require additional hours beyond the workday. At some schools, entire grade levels were trained this way, increasing opportunities for collective participation. Teachers given the opportunity to discuss concepts and problems associated with new curriculum are more likely to continue with collegiate support (Birman et al. 2000, Ni 2007). Early-adopting middle school teachers utilized and valued in-class lesson modeling. Late-adopting middle and early-adopting high school teachers were more autonomous, requiring limited training (~ 2 hours), curriculum resources, project materials, and access to project staff for question/answer sessions.

While weekend training allowed teachers to explore "Educate to Eradicate" content deeply, at-school lesson modeling allows the project to reach more teachers. White (2005) argues that effective professional development deepens teachers' content knowledge, while minimizing additional time demands. Future creation of "Educate to Eradicate" videos may efficiently hybridize professional development to include science content and lesson modeling. Supports beyond professional development were also discussed.

Teachers cited help from their grade level colleagues most often as a key support to project adoption and continuation (15 references). Grade level members helped one another by creating/adapting project materials, preparing copies, setting-up laboratories, issuing grade level reminders, and serving as a project point-of-contact. Assistance from the UH Termite Project staff was also valued by teachers (13 references). Teachers indicated prompt communication, material drop-off/pick-up, curriculum modeling, field trips, and visits from entomologists as favorable staff services. Teachers noted that administration helped by scheduling grade-level planning time and granting teachers fiscal and curricular autonomy. Exciting entire grade levels or departments about curricula, providing technical support, and creating user-friendly lessons that minimize teacher time inputs (White 2005) have the potential to increase curricula continuation.

Continuation Needs

Each focus group brainstormed then ranked project continuation needs. Live termites and habitats were essential. Teachers would not continue the project without live termites. Preserved termites and damage samples were also vital project components. All groups were willing and able to store these samples indefinitely. High and middle school teachers valued laboratory kits. These teachers were willing to house, maintain, and restock kits from year-to-year. One high school teacher had already purchased all materials used during unit instruction and only required live termites each year to continue. All teachers valued project staff services, materials/kits, and were interested in additional resources. However, these were not considered essential for project continuation. Establishing an efficient distribution system, which allows for drop-offs to distant schools, will help insure curriculum continuation.

Change in classroom time allocated to science

At the elementary level, teachers were asked to quantify changes in classroom time devoted to sci-

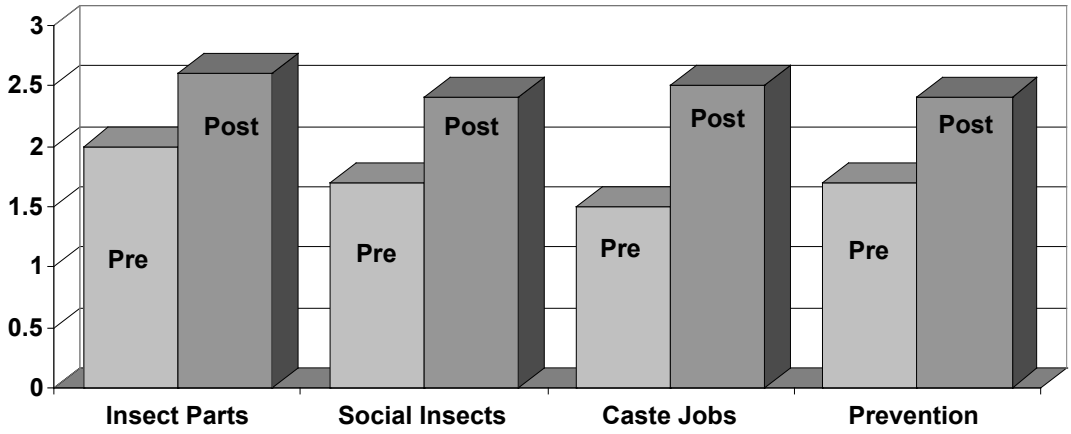
ence. Early adopters emphasized the importance and extensive use of science instruction throughout their teaching careers. They indicated that “Educate to Eradicate” motivated students while honing observation and questioning skills. One teacher stated, “When we… create[d] our other units, we knew that the termite one was so hands-on that we tried to make the other [science units] hands-on because we wanted to have some of those same things that get the kids so excited.” Late adopters reported increasing science instruction to 1.5 hours per week. This was an increase from 45 minutes per week, twice a quarter, or whenever it fit into instruction.

All middle/high groups indicated the UH Termite Project was currently their only project-based unit. Teachers would like to partner with similar standards-based projects that provide hands-on activities and project materials. All middle school teachers indicated partnership with the project resulted in increased technology use and note taking.

Student knowledge and behavior

Partner teachers administered pre- and post-project surveys as part of instruction. A total of 4,750 paired-surveys were received from students in grades 1-12 (48% return rate). Four prompts were consistent across grade levels (Figure 2).

Figure 2. Changes in Student Knowledge, from student surveys grades 1-12



Survey responses from different schools were combined as split-plots. Years of teacher participation was included as a covariate (Table 1).

Table 1. ANOVA for Prevention Prompt

Source	df	Mean Square	*F*	*P*
School	30	2.4	1.1	0.4
Teacher (School)	63	2.2	4.8	<0.0001
Curriculum	1	386.4	18.6	0.0002
Curriculum X School	30	20.8	45.6	<0.0001
Years of Teacher Participation	1	1.7	3.8	0.05

Participation in the “Educate to Eradicate” curriculum had a significant effect on student scores. Average pre-program responses to the prompt “I can list the six prevention steps scientists suggest

my parents take to keep worker termites from damaging our home" averaged between "Not Really" and "I Think So" at 1.7. After curriculum participation, the average response was between "I Think So" and "Yes" at 2.4. Effects of teachers within schools and the interaction between curriculum and school were also significant. Effects were consistent across prompts.

As a culminating activity, students survey their homes with their parents, searching for termite signs and/or termite-conducive conditions. Students use a home survey sheet for the inspection, which includes an area for parent/guardian feedback and comments.

Return and signature rates of this home survey were tallied during the 2010-2011 school year. The home inspection survey was returned by 86% of students. Of those returned, 74% were signed by a parent/guardian.

Conclusions

Teacher adoption of pest management curriculum can be maximized by tightly coupling lessons to the target groups' state standards. Incorporation of live organisms, inquiry, parental involvement, and grade-appropriate pedagogy can increase appeal to teachers. Posters and videos are desirable unit resources, which may reduce the need for project personnel and in class modeling. Curricular materials should to be readily available at low or no cost.

To date, the UH Termite Project has reached over 11,800 Hawaii public school students. Participating students have had significant gains in unit-specific content and prevention knowledge. Additionally, students have communicated their learning to parents/guardians while inspecting their homes for termite signs and/or termite-conducive conditions. The goal of this program is a self-sustaining curriculum that will require limited institutional inputs, increase science literacy in Hawaii schools, and help to protect current and future homeowners from termite damages.

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