National Field Study Executive Summary

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I. EXECUTIVE SUMMARY

Both formative and summative evaluations of the new Project Learning Tree (PLT) were completed by the North American Association for Environmental Education (NAAEE) under a contract awarded to NAAEE by the American Forest Foundation. The evaluation was conducted by members of NAAEE's Commission for Environmental Education Research (NACEER) during the spring of 1994. All activities in the PLT were evaluated.

A modified, quasi-experimental non-equivalent control group design was used (Campbell & Stanley, 1963). Purposes of the evaluation were to determine: (a) if treatment group classes exposed to new PLT activities would achieve significant pre-to-post knowledge and attitudinal gains; and (b) if such gains would be significantly higher than in control group classes. To that end, 20 knowledge and attitude scales were developed and used to collect data (i.e., 5 curriculum strands x 4 grade level groupings). Scales were designed to insure that varying levels of thinking were assessed, and that content and construct validity would be high. Test-retest reliability estimates for scaled ranged from weak through moderate to very high. All students except those in Prekindergarten to Grade 1 responded on scantron forms. PreK-1 students completed tasks (e.g., drawings, ordering pictures). Their responses were transferred onto scantron forms by their teachers. Teacher logs on in-class experiences, and surveys on demographics, education, teaching experience, level of involvement in PLT, teaching conditions, etc., added an important dimension to the design.

The initial sample included 245 teachers from 35 states and 2 Canadian provinces who had volunteered to participate in the evaluation. Usable responses were obtained from 114 teachers, yielding a response rate of 47%. Of these, 64 were treatment group teachers, and 57 were control group teachers. They represented 29 states and 2 Canadian provinces.

Statistical analyses of numeric data were made using the Statistical Package for the Social Sciences (SPSS), Statview, and Statgraphics. Tests employed included: analyses of variance, Student t-tests, effect size analyses, cross tabulations, and Pearson product-moment correlations. Teacher logs and surveys wee also carefully examined for the purpose of identifying information that could be useful in interpreting data and results, as well as guiding further analyses. A summary of the contents of the teacher logs and surveys will be prepared and submitted at a later date.

Results for Knowledge Scale Data

Analyses of variance performed on pre-test data, by strand and by grade level grouping (i.e., for the 20 data cells), indicated that treatment group and control group classes within each cell were not equitable. Therefore, scores from classes in the same data cell could not be combined for analysis purposes.

T-tests were conducted for each treatment group class to identify pre-to-post gains. The results indicated that in more than half of these classes, knowledge gains were statistically significant. Of the 61 t values calculated:

- 17 were significant at the $p < .001$ level (27.9%;
- 22 were significant at the $p < .01$ level (36%); and
- 32 were significant at the $p < .05$ level (53%).

Effect size analyses were conducted to determine if there were significant differences between treatment and control classes within each data cell. Effect sizes (ESs) generally range from 0 to 2.0, and can be positive (treatment group outscoring the control group) or negative (vice versa). Further, an ES of .2 is considered small/low, an ES of .5 is considered moderate, and an ES of .8 or greater is considered large/high. Finally, when interpreting ES results, an ES of 1.0 (high) reflects an increase from the mean on a normal distribution curve (50% mark) up a full standard deviation (to the 84% mark). Researchers have suggested that an ES of 1.0 is equivalent to a knowledge gain of 1 grade level in that subject area. The following table presents the ESs for all strands within each grade level grouping:

GRADE LEVELS	EFFECT SIZES
PreK-1	- 0.48
2-3	0.40
4-6	0.92
7-8	0.54

With the exception of the PreK-1 grouping, the effect sizes were positive, and ranged from moderate to high. It should be noted that the PreK-1 results were difficult to interpret since the protocol for filling out scantron forms sometimes allowed for 2 correct responses, while only one correct response could be ready by the Scanstat program used to "score" these responses. For this reason, an overall ES was calculated both with and without PreK-1 data. These ES values are:

All grade level groupings and strand: .38
Grade levels 2-8 over all strands: .67

Review of teacher logs and surveys yielded important information for the interpretation and reanalysis of knowledge scale data. It was determined that many of the teacher in the treatment group:

1. had never participated in a PLT Teacher Workshop;
2. did not complete teaching all of the assigned PLT activities;
3. did not teach activities as directed in the new PLT guide;
4. modified or shortened assigned activities because the school year was ending; and
5. found testing procedures were too difficult for their students.

Thus, a reanalysis of t-test results was completed in which classes reflecting one or more of these "discrepant" conditions were excluded. The results of this reanalysis revealed that **statistically significant growth in knowledge was achieved in all but two treatment group classes** in which teachers:

1. had completed at least one PLT Teacher Workshop;
2. completed all of the new PLT activities assigned to them;
3. taught the new PLT activities as directed in the new PLT guide;
4. did not modify or rush through assigned activities.

Results for Attitude Scale Data

Attitude scale responses ranged from 1 (low) to 5 (high). Responses in each data cell for Grades 2-8 were collapsed to calculate pre- and post-assessment trends (i.e., 1s and 2s were summed, and 4s and 5s were summed). The 4-5 category was labeled "principled environmentalist" (PE). The results of pre-to-post treatment group comparisons indicated that:

- shifts toward a PE position were found in 11 or 13 data cells;
- shifts toward a PE position were statistically significant at $p < .05$ in 7 of the 13 data cells;
- shifts toward a PE position were statistically significant at $p < .01$ in 5 of the 13 data cells;
- shifts toward a PE position were statistically significant at $p < .001$ in 2 of the 13 data cells;

These results are encouraging, and suggest that the new PLT can have a significant effect upon students' affective growth. In addition, as was done for knowledge scale results, these results were reanalyzed in light of "discrepant" conditions. The results of this reanalysis indicated that discrepant conditions also had an impact upon attitudinal results (i.e., lowering them). Further statistical analysis would be required to determine the degree to which these deviations actually impacted t and p values.

Conclusions

The new PLT program can be an effective program for increasing environmental knowledge and effecting positive attitudinal growth in student in grades PreK-8, and particularly in Grades 2-8. In addition, teachers who have completed at least one PLT Teacher Workshop, and who implement the new PLT activities as intended, are more likely to observe knowledge gains and attitudinal change in their students. This appears to be particularly true when students are exposed to a series of new PLT activities over a relatively short period of time.