IX. Directionality of Selected Effects

Finding 15. Increased Computer Enjoyment appears to lead to higher ratings on Computer Importance.

Finding 16. Higher Creative Tendencies appear to lead to higher Computer Importance.

Educators in many parts of the world believe that appropriate computer activities can improve children's psychological dispositions (prevailing attitudes) related to learning, which will eventually lead to improved cognitive performance (Collis, 1993; Pelgrum & Plomp, 1993). However, research to determine the effects of computer use on creativity has produced mixed results (Bruce, 1989; Clements, 1991; Sakamoto & Sakamoto, 1993), as has research regarding the effect of computer use on motivation for learning outside the computer environment (Krendl and Lieberman, 1988; Lepper, 1985; Sakamoto, Hatano, & Sakamoto, 1992).

During 1993, the authors attempted to formulate a probable causal model among nine computer use, learning disposition, and background variables gathered from subjects over consecutive years, in two nations (Knezek, Miyashita, & Sakamoto, 1994). The attributes involved were: Age, Gender, Computer Exposure, Motivation, Study Habits, Empathy, Creative Tendencies, Computer Importance, and Computer Enjoyment. Two primary techniques were employed. Both were aimed at producing path coefficients for the model.

<u>Method</u>. The first technique, used with the U.S. data, was to treat information gathered at two time intervals, one year apart, as panel data to be analyzed by a cross-lagged model (Markus, 1979). The procedure was to isolate two variables (X and Y) measured at two time intervals (1 and 2), controlling for as many extraneous variables as possible, and then to determine standardized regression coefficients (betas) for the paths (X1 to Y2) and (Y1 to X2). Those paths with significant betas were retained for incorporation into the model (Sakamoto & Sakamoto, 1993; Sakamoto, 1994).

The second technique, employed with the Japan data, was to transform analysis of variance results obtained through a treatment and control group pseudo-experimental design, into standardized regression coefficients which could be used as path coefficients. This was done by constructing a regression model with a dummy vector of ones and zeroes to represent computer exposure or no computer exposure, respectively. Thus paths derived from two types of research could be overlaid into a single model.

<u>Findings from 1993 Japan Data</u>. Figure 14 contains significant (p<.01) path coefficients derived from regression analyses performed on responses from 198 1993 Japanese students in grades 1-4 at two urban public elementary schools in Tokyo.

Four independent regression analyses, for example: Computer Importance = f(Computer Exposure), were carried out--one for each of the significant ANOVA results. The resulting standardized regression coefficients (betas) are written above the probability values on the lines indicating direction of influence in Figure 14. The strongest relationship (beta=.42) is for Computer Enjoyment, while the weakest (betas=.17) are for both Study Habits and Motivation/Persistence. Complete findings were:

1. Computer Exposure leads to greater Computer Enjoyment (beta=.42, p<.00005),
2. Computer Exposure leads to greater perceived Computer Importance (beta=.26, p<.0004),
3. Computer Exposure leads to greater Motivation/Persistence (beta=.17, p<.01), and
4. Computer Exposure leads to more positive Study Habits (beta=.17, p<.01).

Findings from Paired 1991-1992 U.S. Data. A cross-lagged model was applied to paired data from one U.S. school in order to further explore these relationships. Regression equations similar to those used for the Japan data were constructed for the paired 1991-1992 data gathered from the U.S. school. The major change was that time-lag regression models were constructed to attempt to determine the directional influences of psychological dispositions on each other. For example, in order to determine if Creative Tendencies influenced Computer Importance, or if higher Computer Importance led to greater Creative Tendencies, the outcomes of two models were contrasted: 1992 Computer Importance = f(1991 Computer Importance, 1991 Creative Tendencies, Gender, Age) versus 1992 Creative Tendencies = f(1991 Creative Tendencies, 1991 Computer Importance, Gender, Age). As shown in Figure 15, the result was a significant path (beta=.31, p<.001) in the direction of higher Creative Tendencies leading to higher perceived Computer Importance. The influence in the opposite direction was not significant. A total of fifteen pairs of this type of regression equation were produced, one set for each of six psychological dispositions paired with the other five. The significant findings from this analysis were:

1. Higher Creative Tendencies appear to positively influence perceived Computer Importance (beta=.31, p<.001),
2. Greater Computer Enjoyment appears to lead to higher perceived Computer Importance (beta=.26, p<.01),
3. Greater Empathy appears to lead to higher Motivation/Persistence (beta=.25, p<.01),
4. Being female leads to higher Empathy (beta=.37, p<.001),
5. Increased age leads to lower Creative Tendencies (beta=-.32, p<.001), and
6. Increased age leads to less positive Study Habits (beta=-.32, p<.001).

Discussion. The analysis of the data from Japan reconfirms the positive impact of one year or more of computer exposure on Computer Enjoyment and Computer Importance. It also lends additional support to the concept that at least three or four years of exposure to computers in school, at the typical rate, is necessary before a measurable positive impact on Study Habits or Motivation/Persistence takes place. In addition, it reaffirms the negligible impact of Gender and Age on these relations. Taken all together, these results imply that positive benefits of computer exposure accrue to males and females equally, and that the effect may not differ for students of different ages (within the age parameters of grades 1-4).

The time-lag analysis of data from the U.S. school reaffirms that children tend to lower their self-reported Creative Tendencies and self-reported Study Habits as they advance from grade 1 to grade 3 in school. It also reaffirms that females are more Empathetic than males. New findings are probable relations in the direction of higher Empathy leading to higher Motivation/Persistence, higher Computer Enjoyment leading to higher perceived Computer Importance, and higher Creative Tendencies leading to more positive ratings of Computer Importance (which in turn can lead to greater use) (Coovert, Salas & Ramakrishna, 1992). The latter finding is consistent with similar research recently completed in Japan (Sakamoto & Sakamoto, 1993), and calls into question the belief that computer use increases creativity.

The composite model shown in Figure 16 is less valid than either of its halves, because each half is based upon findings from two separate groups in different countries, with data from different years. Nevertheless, there are no contradictions between the two halves of the model, and the combination forms a single, holistic basis for formulating and testing future hypotheses.

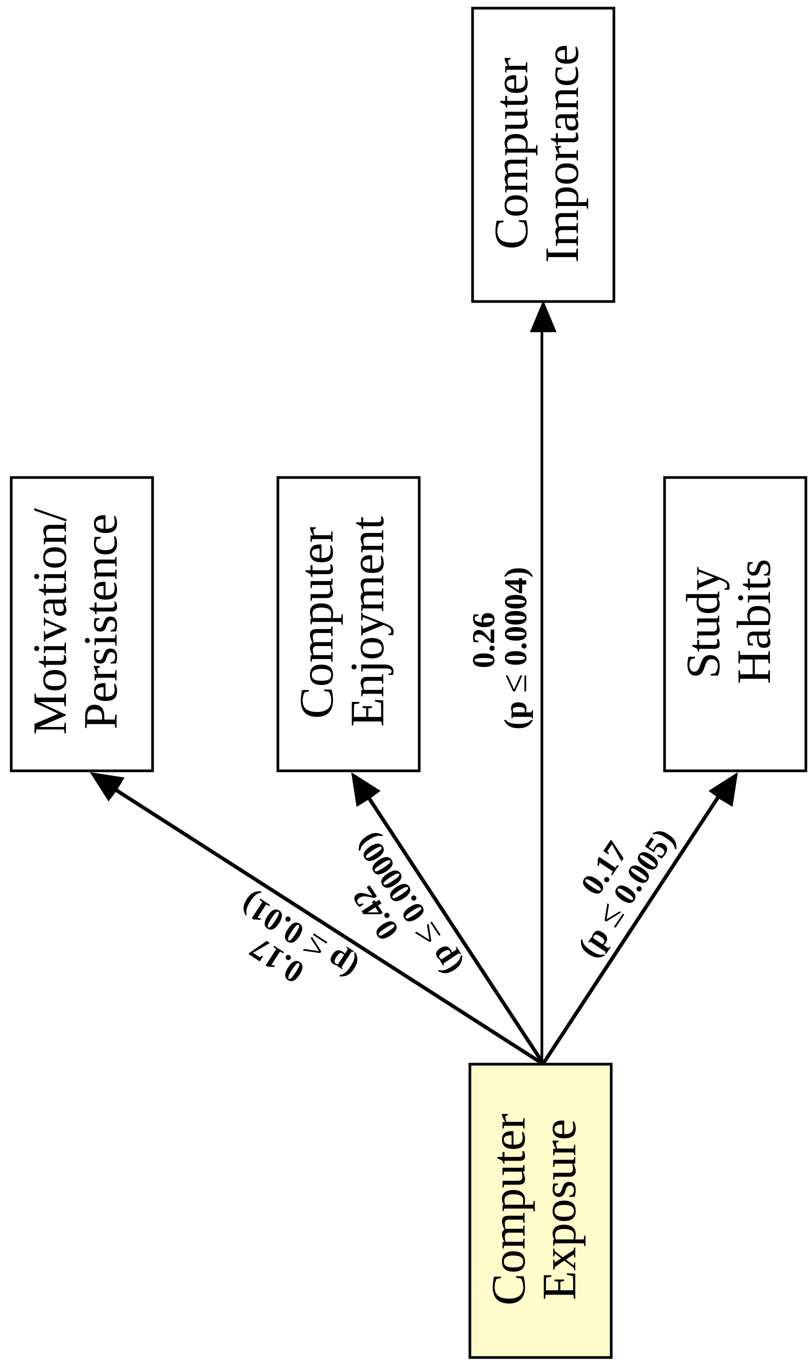

Figure 14. Path Coefficients for Effect of Computer Exposure based on 1993 Japan Data (n=183)

Figure 15. Path Coefficients for Background Variables and Psychological Dispositions based on 1991-92 Paired U.S. Data (n=166)

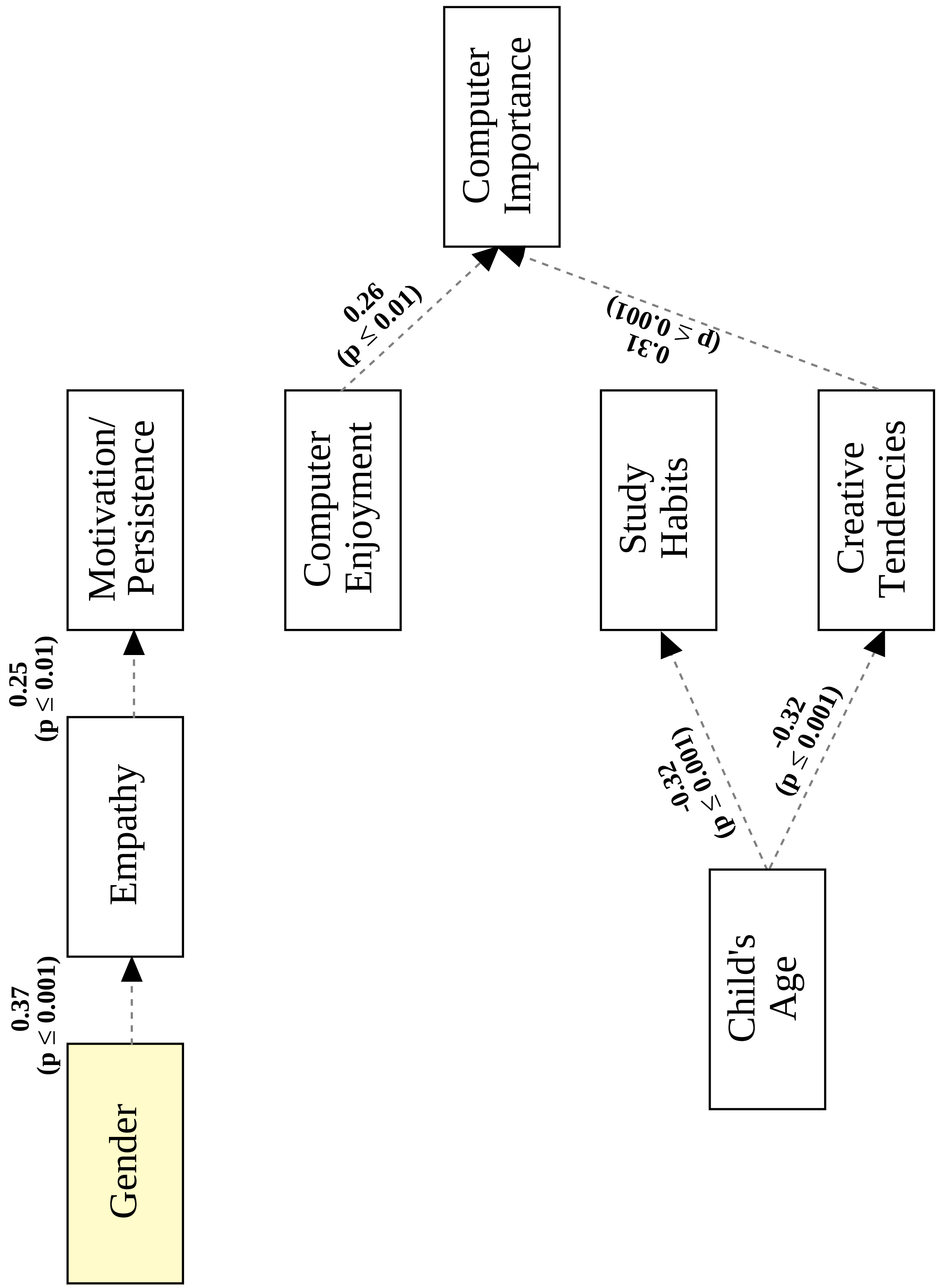

Figure 16. Combined Causal Model, Computer Exposure and Psychological Dispositions