Technical Appendix

Definition

A ‘learning style’ is an individual's unique approach to learning based on their strengths, weaknesses, and personal preferences, often in relation to different modes of information (visual, auditory, tactile, etc.) or in relation to its organisation (e.g. abstract, concrete; wholist, serialist, etc.). Different models in the literature describe these on a continuum from fixed to malleable according to how they conceptualise a particular ‘style’.

The idea underpinning learning styles is that individuals all have a particular approach to or style of learning. The theory is that learning will therefore be more effective or more efficient if pupils are taught using the specific style or approach that has been identified as their learning style. For example, pupils categorised as having a ‘listening’ learning style, could be taught more through storytelling and discussion and less through traditional written exercises. Although this is intuitively appealing, a number of serious issues challenge this field. The first is the robustness of the concept of a learning ‘style’ and which particular version is adopted. Most concepts have not been able to demonstrate sufficient reliability and/or validity. The next major problem is that the ‘meshing’ hypothesis where individuals learn better when targeting their ‘style’ lacks empirical validation. Where positive findings have been found it seems more likely that this impact is due to encouraging learners to take responsibility for choosing a learning strategy or approach, or to teachers presenting the same information in different ways, thereby increasing the repetition of information or enabling connections to be made across different representations. More recent exploration of ‘cognitive’ styles or preferences have attempted to address these issues, but so far with little success.

Search terms: Learning styles; learning preferences; cognitive styles; cognitive preferences.

Evidence Rating

There are four meta-analysis of learning styles and modality preference approaches, three of which found very low effects (-0.03 to +0.14). The fourth, with a pooled effect of 0.67, has been criticised for the validity of the underlying model, for technical problems with the meta-analysis and potential bias in selection and inclusion criteria. None have been conducted in the last ten years. Overall the evidence base is limited.

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Summary of effects

Meta-analyses	Effect size	FSM effect size
Garlinger, D.K. & Frank, B.M., (1986)	-0.03	-
Kavale, K.A. & Forness, S.R., (1987)	0.14	-
Lovelace, M.K., (2002)	0.67	-
Slemmer, D.L., (2002)	0.13	-
Median effect size	0.13	

The right hand column provides detail on the specific outcome measures or, if in brackets, details of the intervention or control group.

Meta-analyses abstracts

3 *Garlinger, D.K. & Frank, B.M. (1986)*

Reviews the effects on academic achievement associated with matching students and teachers on field-dependent–independent dimensions of cognitive style. To integrate and clarify the current status of findings relevant to this issue, a narrative summary of 7 studies is provided, followed by a meta-analysis. Findings suggest that field-independent students show greater achievement when matched with similar teachers.

6 *Kavale, K.A. & Forness, S.R. (1987)*

A literature search identified 39 studies assessing modality preferences and modality teaching. The studies, involving 3,087 disabled and nondisabled elementary/secondary level subjects, were quantitatively synthesized. Subjects receiving differential instruction based on modality preferences exhibited only modest gains.

8 *Lovelace, M.K. (2002)*

(See also Lovelace 2005). The purpose of this investigator was to conduct a quantitative synthesis of experimental studies in which this model had been utilized between 1980 and 2000. Of the 695 different citations elicited by the database and reference section searches, 76 original research investigations met the established inclusion criteria. A total of 7196 participants from these experimental research investigations provided 168 individual effect sizes for this meta-analysis. Data from these investigations were collected, coded, and summarized. The mean effect-size values for students' achievement and attitudes calculated and interpreted by this meta-analysis provided evidence for increased achievement and improved attitudes when responsive instruction was provided for diagnosed learning-style preferences. Not enough data were available to calculate mean-effect size values for behavior. Three tests determined the heterogeneity of the included investigations. Therefore, independent variables that impacted upon effect sizes were examined using both inductive and deductive moderator searches. No significant difference was found between subset categories of twelve of seventeen independent variables for achievement or for sixteen of seventeen variables for attitude. Therefore, there were a total of six moderating variables. No publication bias was revealed by correlations between sample sizes and effect sizes and the calculation of a Fail Safe N statistic. Finally, the current investigation and the previous meta-analysis conducted by Sullivan (1993) and reported in the Journal of Educational Research (Dunn, Griggs, Olson, Gorman & Beasley, 1995) and the National Forum of Applied Educational Research Journal (Sullivan, 1996-7) were compared. The mean effect size results for achievement from the current and the previous meta-analysis were consistent or robust. Therefore, it can be strongly suggested that learning-styles responsive instruction would increase the achievement and improve the attitudes toward learning of all students. Although authors of both studies revealed heterogeneous findings, there were indications that the data were less variable in this investigation and fewer moderating variables were revealed. In summary, although several moderating variables influenced the outcome, the results of this investigation overwhelmingly supported the position that matching students' learning style preferences with complementary instruction improved both academic achievement and student attitudes toward learning. According to Cohen's (1977, 1988, 1992) definitions, all averages for r and d effect sizes for both the previous and the present meta-analysis were medium to large. The Dunn and Dunn Learning Style Model had a robust medium to large effect that was both practically and educationally significant.

12 *Slemmer, D.L. (2002)*

To identify forms of technology or types of technology-enhanced learning environments that may effectively accommodate the learning needs of students, 48 studies were included in a meta-analysis to determine the effects of learning styles on student achievement within technology-enhanced learning environments. A total of 51 weighted effect sizes were calculated from these studies with moderator variables coded for five study characteristics, six methodology characteristics, and six program characteristics. This meta-analysis found that learning styles do appear to influence student achievement in various technology-enhanced learning environments, but not at an overall level of practical significance. The total mean weighted effect size for the meta analysis was zr = .1341. Although the total mean weighted effect size did not reach the established level of practical significance (zr = .16), the value was greater than zr = .10, which is the level generally established by researchers as having a small effect. Additional findings from the moderator variables included: (1) Articles published in journals were the only type of publication that produced a significant mean weighted effect size (zr = .1939). (2) Studies that reported t statistics produced one of the highest total mean weighted effect sizes (zr =.4936) of any of the moderator variables. (3) Studies that reported an F statistic with df = 1 in the numerator had a significant total mean weighted effect size (zr = .2125); while studies that reported an F statistic with df > 1 in the numerator had a non-significant total mean weighted effect size (zr = .0637). (4) When all of the students received the same technology-enhanced lesson, there was a significant difference in student achievement between students with different learning styles (zr = .2952). (5) Studies that used Witkin's learning styles measure indicated a significant interaction between students' learning style and technology-enhanced learning environments as measured by student achievement (zr = .1873), while none of the quadrant-based learning style models indicated a significant interaction. (6) As the duration of treatment increased, the findings of the studies increased in significance. In general, this study provided evidence that under some conditions, students interact differently with technology in technology-enhanced learning environments depending on their specific learning style and the type of technology encountered.