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ABSTRACT

This meta-analysis explored how measuring student progress toward long vs. short-term goals affects achievement outcomes. Twenty-one controlled studies were coded in terms of measuring method (toward long- vs. short-term goals) and type of achievement outcome (probe-like vs. global achievement test). Analogues to analysis of variance conducted on weighted unbiased effect sizes (UES) indicated an interaction: when progress was measured toward long-term goals, UESs on global measures were higher than on probe-like outcomes; when progress was measured toward series of short-term goals, the reverse was true. Implications for special education practice are discussed. (Author)

The Effect of Measuring Student Progress Toward Long vs. Short-Term Goals: A Meta-Analysis

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Running Head: Measuring Student Progress

Abstract

This meta-analysis explored how measuring student progress toward long- vs. short-term goals affects achievement outcomes. Twenty-one controlled studies were coded in terms of measuring method (toward long- vs. short-term goals) and type of achievement outcome (probe-like vs. global achievement test). Analogues to analysis of variance conducted on weighted unbiased effect sizes (UESs) indicated an interaction: When progress was measured toward long-term goals, UESs on global measures were higher than on probe-like outcomes; when progress was measured toward series of short-term goals, the reverse was true. Implications for special education practice are discussed.

The Effect Measuring Student Progress Toward Long vs. Short-Term Goals: A Meta-Analysis

In special education, commercial norm-referenced achievement tests represent the traditional and predominant measurement tool for generating individualized instructional programs and for evaluating the effects of those programs (Ysseldyke & Thurlow, 1984). Despite the prevalence of this measurement approach, it increasingly has been criticized (see Tindal et al., 1985; Ysseldyke & Thurlow, 1984). With respect to generating educational programs, critics contend that the abilities measured by these instruments frequently lack necessary conceptualization (Ysseldyke, 1979), and relatedly that the tests often fail to demonstrate adequate psychometric properties (Salvia & Ysseldyke, 1985). In terms of program evaluation, critics argue that these measures fail to: (a) indicate the extent to which specific educational objectives have been attained (Skager, 1971), (b) provide enough alternate forms to permit ongoing progress monitoring, (c) sample the domains of interest comprehensively (Zigmond & Silverman, 1984), and (d) relate to curricular materials (Armbruster, Stevens, & Rosenshine, 1977; Jenkins & Pany, 1978).

In response to these problems, ongoing criterion-referenced, curriculum-based assessment (CBA) strategies have been developed. With CBA, measurement procedures are designed to match students' program objectives. Alternate test forms are drawn directly from curricula specified in objectives and are administered at regular intervals during intervention; student progress data are evaluated regularly with reference to the performance criteria specified in objectives; and individualized programs are modified as required to insure attainment of objectives. Therefore, with CBA, instructional program evaluation is ongoing and based in the curriculum; program development is inductive, in response to the ongoing program evaluation data.

CBA not only is conceptually stronger than traditional assessment strategies. Data also indicate than it represents an effective alternative approach to program development and evaluation, with an average effect size across available controlled studies of .70 (Fuchs & Fuchs, in press). This indicates that, in terms of the standard normal curve and an achievement test scale with a population mean of 100 and standard deviation of 15, the use of CBA to generate and evaluate individualized programs can be expected to raise the typical achievement outcome score from 100 to 110.50, or from the 50th to the 76th percentile.

Additionally, the requirements of federal legislation seem to indicate the importance of CBA: The IEP mandate of PL 94-142 requires special educators to specify long-term goals, short-term objectives, and assessment procedures for monitoring students' attainment of goals and objectives. Assuming that the intent of this legislation was to base goals and objectives in pupils' curricula, then the IEP mandate requires a CBA approach to progress evaluation.

Despite the apparent effectiveness of and seeming necessity for CBA, it remains unclear how practitioners should design CBA procedures to monitor students' attainment of goals and objectives. One reason for this lack of clarity stems from the IEP mandate, itself, which fails to specify whether student progress should be monitored toward the relatively broad goal statements or the more numerous and narrow objectives that typically are generated for each IEP goal. Currently, practitioners can select between two types of CBA, one focusing on the attainment of long-term goals (CBA-goal) and the other of short-term objectives (CBA-objective).

With the CBA-goal approach, an annual curriculum-based goal is specified and a large pool of related measurement items is created. From this measurement pool, subsets of items, or monitoring probes, are drawn randomly (see Fuchs, Deno, & Mirkin, 1984). The difficulty level of the monitoring probe remains constant over a long time. Contrastingly, with the CBA-objective approach, a series of objectives corresponding to steps within a hierarchical curriculum is specified, and a series of relatively circumscribed, small pools of items are created, each of which corresponds to a specific objective (see Lindsley, 1971; White & Haring, 1980). The difficulty level of material on which students are measured increases as students master the sequentially-related objectives.

Both types of CBA are ongoing, criterion-referenced, curriculum-based, and enjoy strong curricular validity or correspondence between tests and programmatic goals and objectives (McClung cited in Popham & Yalow, 1984). However, these systems do differ conceptually. CBA-objective appears to have stronger instructional validity or correspondence between tests and instruction (Yalow & Popham, 1984). The monitoring probes for short-term measurement are related directly to current instructional material, so, for example, if an instructional intervention is introduction of the r-controlled phonics rule, the monitoring measure is reading r-controlled words. Alternately, with CBA-goal, the monitoring probes are not related to the instructional material. The instructional intervention may be introduction of the r-controlled phonics rule, whereas the monitoring measure may involve oral reading fluency, accuracy, and/or comprehension on second grade passages.

Although CBA-objective may enjoy stronger instructional validity, CBA-goal is advantageous in other respects. It possesses better content validity or representation of the ultimate desired performance, i.e., reading fluency/comprehension (Yalow & Popham, 1984). Additionally, its concurrent validit: or correlation with other measures of achievement appears to be stronger than that of CBA-objective (Fuchs, 1982).

The emergent question, and the focus of the current meta-analysis, is how well these types of ongoing criterion-referenced, curriculum-based assessment strategies relate to outcome measures of student achievement. The investigation of this question should help practitioners assess the relative merits of the two types of CBA, and select CBA monitoring procedures that maximize student growth.

Method

Search Procedure

The search for pertinent studies to include in the meta-analysis comprised four steps. First, employing the Thesaurus of Psychological Index Terms (APA, 1982), multiple descriptors were generated for key terms. For example, student achievement alternately was represented by "student progress," "goal attainment," and "educational effects." Second, these terms facilitated a computer search of three on-line data bases: (a) ERIC, a data base of educational materials from the Educational Resources Information Center consisting of abstracts from Research in Education d Current Index to Journals in Education; (b) Comprehensive Dissertation Abstracts; and (c) Psychological Abstracts. Third, employing similar key descriptors, a manual search was conducted of five educational journals for the years 1973 through 1983. These journals were: American Educational Research Journal, Journal of Learning Disabilities, Journal of Precision Teaching, Journal of Special Education, and Learning Disability Quarterly. Fourth, the reference sections of relevant papers along with identified bibliographies were explored for additional studies.

Criteria for Relevant Studies

A study was considered for inclusion if it employed a control group to evaluate the effects of curriculum-based monitoring on academic achievement. Such monitoring was defined as curriculum-based data collection that occurred at least twice weekly, with decisions concerning the adequacy of programs formulated on an individual, not group, basis. Studies were excluded that (a) monitored social behaviors, (b) primarily focused on the use of behavior modification, while employing time series to test experimental effects, (c) provided test feedback only to students, and/or (d) employed college age students as subjects.

The search yielded 29 studies that met the criteria established for inclusion. From these studies, 8 were eliminated because of insufficient data for calculating meta-analytic statistics.

Data Extracted from Each Study

Data aggregation. Guidelines were established to ensure that each relevant effect was counted only once in analyses. When an effect was measured by different instruments or by subtests that failed to represent dimensions relevant to the meta-analysis (i.e., Reading Comprehension and Structural Analysis Subtests of the Stanford Diagnostic Reading Test), results from the instruments or subtests were pooled. For example, if achievement within a study were measured with three global tests and two probe-like measures, the three effect sizes for the global tests would be averaged as would be done for the two probe-like tests. So, two, rather than five, effect sizes would be included for such a study.

Definition and calculation of effect size. Results of the studies were transformed to a common metric, effect size, defined here as the difference between the treatment means, divided by the control group standard deviation. For purposes of analysis, an effect was given a positive sign if subjects achieved greater scores in the systematic monitoring treatment. For studies reporting relevant means and standard deviations for both groups, effects sizes were calculated from these measurements. For studies not reporting means and standard deviations, effect sizes were calculated from other statistics, such as F or p values (see Glass, McGaw, & Smith, 1981).

Each effect size was converted to an unbiased effect size (UES) to correct for inconsistency in estimating true from observed effect sizes (Hedges, 1981). The difference between the observed and unbiased effect sizes was neglible ($\bar{X}$ = .019, SD = .025) as has been demonstrated elsewhere (Bangert-Drowns, Kulik, & Kulik, 1983). Nevertheless, UESs were employed to insure the mathematical tractability of the data.

There were 96 effect sizes, with between 1 and 12 effect sizes per study. Analyses indicated no statistical dependency between effect size magnitude and number of comparisons per study (r =.12). Therefore, UESs were aggregated at the individual effect size level. In combining these UESs, weighted averages were calculated to account for the variances of the UESs (see Hedges, 1984).

Study features. To describe study features pertinent to the current investigation, two major substantive variables were identified and coded for each study. The first study feature was type of type of goal. This variable had two levels that differentiated studies in which progress toward long-term goals (CBA-goal) was monitored from studies in which progress toward a short-term objective or a series of short-term objectives (CBA-objective) was monitored.

Studies in which progress toward long-term goals was monitored involved the specification of a level of material on which a student was expected to be proficient within the next 15 or more weeks. For example, for a student currently reading proficiently on primer material, a student's goal might specify that, in 25 weeks, a student would read 75 words per minute correct with 90% accuracy on second grade reading passages. Then, for the next 25 weeks, measurement probes would be randomly sampled from the second grade reading passages, representing approximately equivalent samples of measurement material.

Studies in which progress toward short-term goals was monitored required the identification of a sequence of small segments in a hierarchical curriculum to be mastered by the student. For example, the series of objectives might specify that the student would read, with 90% accuracy, flashcards first with consonant-vowel-consonant words, second with final e words, and third with double vowel words. Proceeding in a fashion parallel to the specification of objectives, measurement probes first would be drawn from flashcards with consonant-vowel-consonant words until the mastery criterion was achieved by the student on that domain. Then, the measurement domain would change so that probes were flashcards with final e words, and so on.

The second study feature was outcome measure. This variable also had two levels: dependent measures similar to the monitoring probes and more global achievement tests. Employing the examples provided above, probe-like outcome indices were oral reading rate on second grade passages or percentage read correctly from flashcards with final e words; global achievement tests were the Structural Analysis and Reading Comprehension Subtests of the Stanford Diagnostic Reading Test.

In addition to these two substantive features, a third, methodological variable was coded for each study, duration of the treatment. This variable had three levels: treatments implemented for less than 3 weeks (coded "1"); treatments lasting between 3 and 10 weeks (coded "2"); and treatments continued for more than 10 weeks (coded "3"). A previous investigation (Fuchs & Fuchs, in press) explored methodological quality of the studies and identified no relation between effect size magnitude and study quality.

Two raters independently coded 10 of the 21 studies (48%). Percentage of agreement[1] for the raters on type of goal, outcome measure, and duration of treatment, respectively, was .90, .80, and 1.00.

Characteristics of the Sample

Of the 23 references listed in the Appendix, which represent 21 separate investigations,[2] there are 4 dissertations, 11 unpublished studies, and 8 journal articles. Among the published papers, 3 appeared in Exceptional Children, 2 in

American Educational Research Journal, and 1 each in Teaching Exceptional Children, American Journal of Mental Deficiency, and Journal of Precision Teaching. A total of 3835 subjects participated in these studies, with 83% if the investigations employing handicapped subjects. Of these handicapped pupils, 98% were mildly to moderately handicapped and 2% were severely handicapped. The grade level of these subjects ranged from preschool through high school, with a median grade level of 3.8. Among the 21 investigations, 8 (38%) focused solely on the academic area of reading, 4 (19%) on reading and math, 3 (14%) only on math, and 1 (5%) each on (a) high school content areas, (b) preschool skills, (c) spelling, (d) math and spelling, (e) reading, math, and spelling, and (f) writing, math, and spelling.

Results

Of the 96 effect sizes, 27 related to long-term goal measurement and 69 to short-term goal measurement. Of the 27 long-term goal effect sizes, 14 were associated with proble-like and 13 with global outcome measures. Of the 69 short-term goal effect sizes, 37 were related to probe-like and 32 to global outcome measures.

Relation between treatment duration and other effect size features. A pair of t tests was run to determine whether measurement goal or outcome measure was related to the duration of treatment. These tests indicated no statistically significant associations. For the long-term goal effect sizes, the mean coded level of treatment duration (see above) was 2.92 (SD = .27); for the short-term goal effect sizes, 2.75 (SD = .46), t (95) = 1.81, ns. The average level of treatment duration for effect sizes associated with probe-like and global outcome measures, respectively, were 2.78 (SD = .51) and 2.76 (SD = .23), t (95) = .24, ns. The absence of a relation between treatment duration and type of measurement goal or dependent measure permits a relatively straightforward interpretation of the analyses presented below.

Relation between effect size magnitude and effect size features. Table 1 displays the weighted UESs by (a) the type of goal factor (long-term goal vs. short-term objective) and (b) the outcome measure factor (probe-like vs. global achievement test). To examine the relation between these variables and effect size magnitude, Hedges's (1984) analogue to analysis of variance was employed. When conventional analysis of variance is conducted on effect sizes, problems exist because of the possibility that systematic variance will be pooled into the estimate of error variance. Moreover, violation of the homoscedasticity assumption is severe in research synthesis, and there is little reason to believe that the usual robustness of the F test will prevail (see Hedges, 1984). Thus, Hedges's analogue to analysis of variance was employed to avoid these conceptual and statistical problems. As indicated in Table 1 neither factor produced a statistically significant difference in the UESs.

Insert Table 1 about here

Nevertheless, additional analyses suggested the presence of an interaction between type of goal and outcome measure. Specifically, the effect of the type of outcome measure was analyzed within each of the type of goal conditions. As shown in Table 2 and Figure 1, within the type of goal conditions, there were statistically significant differences between UESs associated with the proble-like and the global outcome measures. With CBA-objective, UESs associated with probe-like outcome measures were higher than those of global measures. For CBA-goal, the reverse was true: UESs associated with global measures were higher than those related to probe-like outcome measures.

Insert Table 2 and Figure 1 about here

Discussion

The purpose of this meta-analysis was to investigate how well measuring progress toward long- vs. short-term goals relate to contrasting outcome measures of student achievement. Toward this end, a literature search was conducted, resulting in the identification of 21 relevant studies that provided sufficient information for the calculation of meta-analytic statistics. These studies were coded for long-term vs. short-term goal measurement and for probe-like vs. global outcome achievement measures. To investigate a possible confound inherent in such a study, that short-term and long-term goal measurement or probe-like and global achievement measures might be related to the duration of the experimental treatment, study durations also were coded. Analyses indicated no reliable association between either substantive variable and treatment duration.

Analgues to analysis of variance indicated that the magnitude of effect size was not related either to the type of outcome measure employed or to the type of goal on which monitoring occurred. However, additional analyses suggested an interaction: When progress was measured toward long-term goals, effect sizes on global outcome measures were higher than on probe-like outcomes. On the other hand, when progress was measured toward series of short-term goals, effect sizes were greater on probe-like than on global outcome measures.

This finding may be explained in terms of the types of validity associated with the different goal measurement strategies. With long-term goal measurement, instructional validity is relatively poor whereas content and concurrent validity may be comparatively strong. For example, a student might be measured, over a year-long period, on oral reading rate and accuracy in material one year above instructional level. Such measures clearly are unrelated to instructional activities, but have been shown to correlate well with global measures of reading skills, including tests of decoding, word recognition, and comprehension (Deno, Mirkin, & Chiang, 1982; Fuchs, 1981). Therefore, it is not surprising that, in this study, measuring student progress toward long-term goals was associated more strongly with global achievement outcome measures than to more narrow measurement probes.

On the other hand, with short-term goal measurement, instructional validity is relatively high while content and concurrent validity may be comparatively limited. For example, a student might be measured, over a year-long period, on a series of short-term objectives, each of which is related clearly to the current instructional material. However, Quilling and Otto (1971) found that mastery of a hierarchy of reading decoding skills related inconsistently to global indices of reading achievement. Therefore, it is not surprising that, in this investigation, measuring student progress toward short-term goals was associated more strongly with performance measures similar to the probes on which monitoring occurred than with global achievement measures.

Teachers may prefer short-term goal measurement because it is easier to understand and it guides . struction more directly by providing information about when to progress from one skill to another (Fuchs, Wesson, Tindal, Mirkin, & Deno, 1982). Nevertheless, as demonstrated in this meta-analysis, short-term goal measurement may be misleading: While students master a series of instructional objectives, progress on more global indices of achievement may be limited, failing to reflect this gain. Additionally, practitioners freqently specificy long lists of short-term objectives on IEPs (Gillespie-Silver, Schachter, & Warren, 1980), a phenomenon that can make short-term objective measurement more cumbersome and time-consuming than long-term goal measurement: Short-term objective monitoring may require teachers to adapt measurement probes and procedures more often.

The finding that long-term goal monitoring relates better to global achievement outcome measures may be especially important in the education of handicapped students, who typically have poorly developed strategies for maintaining and transfering skills (Anderson-Inman, Walker, & Purcell, 1984; White, 1984). Short-term goal measurement focuses on instructionally related, relatively restricted domains of material for a period of time and then, upon mastery of that material, the measurement and instructional focus simultaneously changes. Such a paradigm may be problematic for at least two reasons. First, a close connection between instruction and measurement may encourage teachers to present new skills to students within the framework of the measurement task. For example, if the measurement procedure requires the pupil to read consonant-vowel-consonant words from a list, the teacher may focus instruction on reading consonant-vowel-consonant words from a list. As noted by Goodstein (1982), there may be danger in tying the instructional format too closely to the assessment device or of narrowly defining content-x-format domains of criterion-referenced assessment. Such a restricted instructional format may limit the transfer of skills.

Second, simultaneously changing instructional focus and measurement domain may fail to encourage teachers to review material sufficiently to allow for long-term skill maintenance and generalization. A more global, long-term goal approach to measurement, which still is rooted in the curriculum and is criterion-referenced, may encourage teachers to encorporate instructional procedures that better allow for maintenance and generalization of skills.

Findings may be relevant not only to the development of systematic, continuous progress evaluation procedures but also to teachers' less formal monitoring strategies, including the periodic use of commercial criterion-referenced measures such as basal series mastery tests and the Brigance (1978). Data generated from periodic administrations of such instruments, where test domains are tied closely and narrowly limited to the instructional focus, may fail to relate to global academic progress. Therefore, teachers might exert caution as they interpret such data bases.

Finally, a summative comment seems warranted. As practitioners develop their programmatic or IEP goal and objective statements and their related curriculum-based assessment procedures for monitoring pupil progress toward those goals and objectives, it seems important for them to keep in mind the distinction between curricular and content validity. Curricular validity refers to the match between testing and IEP goals and objectives; content validity, the correspondence between testing and the true domain in which proficiency is desired (Yalow & Popham, 1983). It is only when practitioners write "significant rather than trivial" (Popham et al., 1985) IEP goals and objectives, which relate well to the true desired outcome performance, that curricular and content validity of curriulum-based assessment are both strong. It is only under these conditions that "measurement-driven instruction" (Popham et al., 1985), or ongoing assessment of pupils progress to guide instructional planning, has an important, global effect on pupil achievement. This, together with findings of the current meta-analysis, suggest that curriculum-based assessent of long-term goals, which accurately reflect the desired outcome performance, may represent a better strategy for monitoring pupil progress than the assessment of narrowly circumscribed short-term objectives.

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Footnotes

[1]Percentage of agreement was calculated using the following formula (Coulter cited in Thompson, White, & Morgan, 1982): Percentage of agreement = agreements between observer A & observer B/(agreements between A & B + disagreement between A & B + omissions by A + omissions by B.

[2]One paper authored by Haring (1971) and two additional reports by Haring & Krug (1975a, 1975b) described aspects of the same investigation. Therefore, although it is reported that 21 studies were employed in the meta-analysis, 23 appear in the Appendix due to the separate listing of the Haring and the Haring and Krug papers.

Table 1

Weighted Mean UESs, z Values, and Chi-Square Statistics as Analogues to Analysis of Variance by Type of Goal and Outcome Measure Factors

Factor	Weighted $\bar{X}$	z Value[a]	N[b]	χ^2	df
Type of Goal			96	.69	1
Long-term	.63	16.58	27		
Short-term	.67	24.82	69		
Outcome Measure			96	6.63	1
Probe-like	.72	23.23	45		
Global	.61	19.06	51		

[a] A signficant z value irdicates that the weighted mean is reliably different from zero. All z values are significant beyond the .001 level.

[b] N represents number of UESs not number of studies.

Table 2

Weighted Mean UESs, _z_ Values, and Chi-Square Statistics as Analogues to Analysis of Variance for Probe-Like and Global Outcome Measures within Type of Goal Conditions

Type of Goal/ Outcome Measure	Weighted $\bar{X}$	_z_ Value[a]	_N_[b]	χ^2	_df_
Short-Term Goal					
Outcome Measure			69	56.78[c]	1
Probe-Like	.85	22.97	37		
Global	.45	11.54	32		
Long-Term Goal					
Outcome Measure			27	41.59[c]	1
Probe-Like	.41	7.32	14		
Global	.92	16.73	13		

[a] A significant _z_ value indicates that the weighted mean is reliably different from zero. All _z_ values are significant beyond the .001 probability level.

[b] _N_ represents number of UESs not number of studies.

[c] $p < .001$.

Figure Caption

Figure 1. Unbiased mean effect sizes (UESs) for CBA-objective (———) and CBA-goal (----) on probe-like and global outcome measures.

Appendix

Reports Included in the Meta-Analysis

Beck, R. (1976). Report for the Office of Education dissemination review panel. (Unpublished manuscript available at Precision Teaching Project, 3300 Third St. N.E., Great Falls, MT 59404.)

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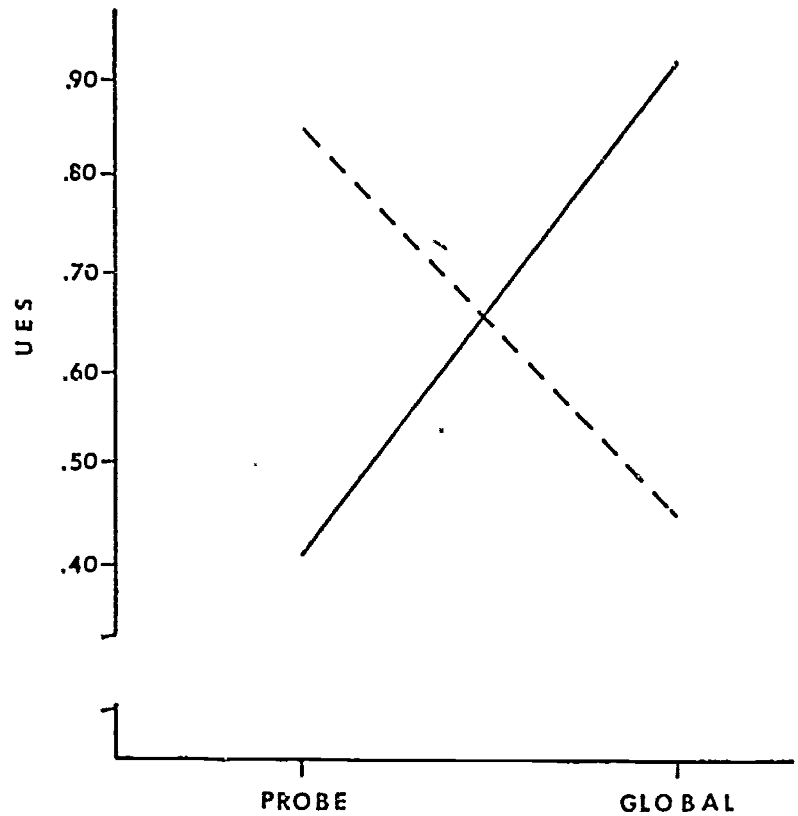
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