

ED 375 181

TM 022 193

AUTHOR Hymel, Glenn M.; Dyck, Walter E.  
 TITLE Mastery Learning in the European Research Community.  
 PUB DATE Jul 93  
 NOTE 16p.; Version of a paper presented at the European Congress of Psychology (3rd, Tampere, Finland, July 4-9, 1993).  
 PUB TYPE Reports - Evaluative/Feasibility (142) -- Speeches/Conference Papers (150)  
 EDRS PRICE MF01/PC01 Plus Postage.  
 DESCRIPTORS Educational Psychology; \*Educational Research; Elementary Secondary Education; Foreign Countries; Intervention; Literature Reviews; \*Mastery Learning; Models; \*Research Methodology; \*Sociocultural Patterns  
 IDENTIFIERS Bloom (Benjamin S); \*Europe

## ABSTRACT

Mastery learning represents an increasingly prolific area of research in educational psychology that encompasses two principal characteristics: (1) an optimistic set of assumptions regarding the capability of students to learn if alterable variables comprising the conditions of learning are optimized; and (2) an array of adaptive instructional procedures predicated on the medical model of diagnostic-prescriptive intervention. From both theoretical and practical perspectives, mastery learning has been a catalyst for paradigm shift from a dominant prediction-selection model to an emerging diagnostic-development model. Since Bloom's seminal publication in 1968, the preponderance of the mastery learning literature has focused on the North American experience and its sociocultural interpretations with only occasional documentation of mastery learning efforts in other parts of the world. In response to this imbalance, this paper attempts to review mastery learning efforts in the European research community over the past 25 years. Attention is given to developments in mastery learning theory and practice as documented in several European countries with a view toward acknowledging and expanding research in this area of educational psychology. (Contains 71 references.) (Author/SLD)

\*\*\*\*\*  
 \* Reproductions supplied by EDRS are the best that can be made \*  
 \* from the original document. \*  
 \*\*\*\*\*

U.S. DEPARTMENT OF EDUCATION  
Office of Educational Research and Improvement  
EDUCATIONAL RESOURCES INFORMATION  
CENTER (ERIC)

- This document has been reproduced as received from the person or organization originating it.  
 Minor changes have been made to improve reproduction quality.

- Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS  
MATERIAL HAS BEEN GRANTED BY

GLENN M. HYMEL

Mastery Learning

1

TO THE EDUCATIONAL RESOURCES  
INFORMATION CENTER (ERIC)."

## Mastery Learning in the European Research Community

Glenn M. Hymel  
Loyola University  
New Orleans, Louisiana  
United States

Walter E. Dyck  
University of Antwerp  
University of Brussels  
Belgium

Revised version of a paper presented at the III European Congress of Psychology, Tampere, Finland, 4-9 July 1993.

Reactions to this paper are encouraged and may be directed to Dr. Glenn M. Hymel, Chairman & Associate Professor, Department of Psychology, Loyola University, New Orleans, LA 70118, USA; Telephone: 504-865-3257; Fax: 504-865-2149; Internet: HYMEL@MUSIC.LOYNO.EDU

2

BEST COPY AVAILABLE

ED 375 181

022193

ERIC  
Full Text Provided by ERIC

## Abstract

Mastery learning represents an increasingly prolific area of research in educational psychology that encompasses two principal characteristics: (a) an optimistic set of assumptions regarding the capability of students to learn if alterable variables comprising the conditions of learning are optimized and (b) an array of adaptive instructional procedures predicated on the medical model of diagnostic-prescriptive intervention (Bloom, 1968, 1976). From both theoretical and practical perspectives on learning and instruction, then, mastery learning has served as a catalyst for a paradigm shift from a dominant prediction-selection model to an emerging diagnostic-development model (Dyck, Van de Looverbosch, & Wouters, 1982).

Since Bloom's seminal publication in 1968, the preponderance of the mastery learning literature has focused on the North American experience and its socio-cultural interpretations with only occasional documentation of mastery learning efforts in other parts of the world. In response to this imbalance in the mastery learning literature, this paper attempts to review those mastery learning efforts that have occurred in the European research community over the past 25 years. Accordingly, attention is given to developments in mastery learning theory and practice as documented in several European countries with a view toward acknowledging and expanding research in this area of educational psychology.

### Mastery Learning in the European Research Community

Mastery learning focuses on the relationship between the concepts of instructional/learning time as a variable and high student achievement as a constant. In the context of the 20th century, this conceptual and research emphasis can be traced initially to the efforts of Washburne (1922) and Morrison (1926) and, more recently, to the seminal work of Carroll (1963).

#### Carroll's Model of School Learning

John B. Carroll's (1963) model of school learning is a theoretical paradigm that describes the degree of learning that occurs in a school setting as a function of the time spent by a student on a learning task divided by the time needed by the student for the mastery of that task. The model, then, is formulated as follows:

$$\text{Degree of Learning} = f (\text{Time Spent/Time Needed})$$

Additionally, Carroll's model suggests that a student's time needed to learn a particular task is determined by such variables as the student's aptitude and ability to understand instruction as well as the quality of instruction to which the student is exposed. Regarding the numerator in the model, time spent, Carroll identifies such factors as student perseverance on the learning task and opportunity to learn as the principal determining variables.

#### Mastery Learning's Two Dimensions

Benjamin S. Bloom's (1968, 1971, 1976, 1978, 1980) mastery learning represents an increasingly expanding research area in educational psychology that is predicated on Carroll's model and encompasses two major dimensions: (a) It entails an optimistic set of assumptions regarding the capability of students to learn what we have to teach them provided that certain alterable variables constituting the essential conditions of learning are optimized. (b) It specifies a set of adaptive instructional procedures reflective of the medical model of diagnostic-prescriptive intervention. Mastery learning, then, suggests that success or failure in school learning is largely an artifact of the extent to which we adequately accommodate certain learner-based and instruction-oriented variables considered to be alterable rather than static.

### Optimistic Theoretical Assumptions

Regarding the optimistic theoretical assumptions of mastery learning, Bloom (1968, 1971, 1976, 1978, 1980) and his colleagues (most notably: Anderson & Block, 1985; Block, 1971, 1980, 1985) have argued that under favorable learning conditions the following expectations are indeed viable: (a) Most students--perhaps over 90%--can master what we have to teach them, thereby resulting in a desired negatively skewed distribution of achievement scores rather than the unfortunate though frequently cherished normal bell-shaped distribution of scores. (b) As many as 80% of our students can attain those high levels of achievement typically reached by only the top 20% of students. (c) Most students become very similar--rather than dissimilar--with respect to learning ability, rate of learning, and motivation for further learning as they progress more deeply into a given course and/or program of studies. (d) Profound advancements in student performance occur not only in the domain of cognitive learning but also in the affective realms of student attitudes, interests, self-concept, and mental health.

### Adaptive Instructional Procedures

Concerning the adaptive instructional practices of mastery learning that reflect a type of diagnostic-prescriptive intervention, Anderson (1981) has focused on the following functions served by mastery learning components regardless of how they are named: (a) communicating positive expectations to students, teachers, administrators, and parents; (b) teaching new content/objectives within a larger subject-matter context and at appropriate levels of difficulty by way of relating the new learning to prior learning; (c) monitoring student learning via diagnostic-progress tests and making instructional decisions based on this ongoing evidence; (d) prescribing corrective work when needed to help students overcome errors and misunderstandings before they accumulate and interfere with subsequent learning tasks; and (e) basing student grades on their performance relative to pre-specified learnings that are sought rather than relative to the performance of other students.

### Catalyst for Paradigm Shift

In both the theoretical and practical realms, then, mastery learning has served as a major catalyst for encouraging nothing less than a paradigm shift where the nature of learning and instruction is concerned. As suggested by Dyck (1976), Dyck and Wellens (1979), and Dyck and Wouters (1989), the dominant prediction-selection paradigm has emphasized such themes as a static conception of individual differences, revealing and analyzing individual differences, heterogeneity as outcome and

purpose of instruction, norm-referenced testing, selection of talent, and a nominal period of instruction and learning. By way of contrast, these same authors characterize the emerging diagnostic-development or outcome-based paradigm associated with mastery learning as highlighting such notions as pursuing equal outcomes, searching for alterable learner- and instruction-oriented variables, expecting success by virtually all students in the context of minimal variance, criterion-referenced testing, development of talent, and a focus on time-on-task.

#### Mastery Learning Considered Internationally

Over the past 25 years since the appearance of Bloom's (1968) article titled "Learning for Mastery," most of the mastery learning literature has focused on the North American experience and its socio-psych-cultural interpretations with only occasional documentation of mastery learning efforts in Western Europe, Asia, the Middle East, South America, and Australia (Anderson & Block, 1985; Hymel, 1990, 1991; Thomas, 1985). This pattern had been suggested earlier--and later corroborated--by entries in a comprehensive bibliography on mastery learning (Hymel, 1982), state-of-the-art literature reviews on mastery learning (Block & Burns, 1976; Guskey & Gates, 1986; Guskey & Pigott, 1988; Kulik, Kulik, & Bangert-Drowns, 1990; Kulik, Kulik, & Cohen, 1979), and attempts to identify major gaps in the literature that suggest future directions for mastery learning efforts (Hymel, 1990, 1991).

In response to this paucity of a worldwide perspective on mastery learning in the professional literature, a paper (Hymel & Dyck, 1992) delivered last year at the 25th International Congress of Psychology in Brussels attempted to initiate an international focus on mastery learning. Included among the several objectives of that paper was the acknowledgment of mastery learning efforts in approximately 30 nations beyond North America.

#### Sources & Methods for a European Focus

The role of North American-rooted data bases such as ERIC and Psychological Abstracts is obviously foundational to locating mastery learning documentation. These are augmented on the international scene--particularly with respect to the European community--by (a) the British Education Index, (b) the Bulletin signaletique des Sciences de l'Education in France, and (c) EUDISED that spans 16 countries in Western Europe. These repositories do not, however, suffice as the sole sources of information on mastery learning programs and personnel. Another option that exists and has been used fruitfully is that of the so-called foreign affiliate membership rosters of national professional organizations (e.g., AERA and APA). Furthermore,

membership lists from international organizations (e.g., the International Council of Psychologists and the International Association of Applied Psychology) are useful in tandem with those of national organizations as a basis for periodic mailed surveys inviting input on mastery learning efforts that for whatever reason are not included in the standard data bases. Finally, as alluded to earlier the availability of various communication networks linking scholars who share similar research interests can ensure an ongoing dissemination of professional knowledge that otherwise may go untapped.

#### European Locations & Topical Areas

The following mastery learning citations are associated with authors, institutional affiliations, and/or research settings geographically positioned in Europe. Furthermore, each citation acknowledges the topical area(s) addressed by the mastery learning effort. Accordingly, they are as follows: Belgium (Dyck & Vanden Berghe, 1975--Evaluation; Dyck & Wellens, 1979--Theory & Practice, Teacher Education; Dyck & Wouters, 1989--Theory & Practice, Teacher Education; Dyck, Van de Looverbosch, & Wouters, 1982--Theory & Practice, Teacher Education); England (Arblaster, 1991--Reading; Backler, 1979--Geography; Collins, 1978--Biology; Gains, 1976--Remediation; Hermann, 1986--Theory & Practice; Leith, 1983--Theory & Practice; Mercer, 1986--Theory & Practice; Miller, Norton, & Servant, 1979--Chemistry; Pennycuik & Murphy, 1986--Psychometrics; Shale & Cowper, 1982--CAI; Spencer, 1990--Secondary Education, CAI; Straker, 1988--Mathematics & Science; Sumner, 1975--Theory & Practice); Finland (Lahdes, 1983--Theory & Practice); France (Council of Europe, 1975--Compensatory Education); Germany (Langeheine, 1992--Psychometrics; Sandrin, 1990--Theory & Practice); Ireland (Whiting, 1982, 1984--Psychometrics); The Netherlands (Boonstra, nd--Theory & Practice; Creemers, 1976--Theory & Practice, Management; de Gruijtes, 1985--Psychometrics; Reezigt & Weide, 1990--Language & Mathematics; Slavenburg & Peters, 1989--Theory & Practice; Van der Linden, 1987--Psychometrics; Vos, 1988--Psychometrics; Warries, 1974, 1979--Psychometrics, Theory & Practice; Weeda, 1982--Theory & Practice); Norway (Skaalvik, 1975--Evaluative Study); Scotland (Drever, 1987--Secondary Education; Johnstone, Mitchell, & Parkinson, 1980--Foreign Languages; Parkinson, Mitchell, & Johnstone, 1983--Foreign Languages; Peacock, 1981--Language Arts); Sweden (Dahllof, 1978--Evaluative Study; Fischbein, 1979--Developmental Psychology); and Switzerland (Flammer, 1973--Theory & Practice).

### Potential European Contacts on Mastery Learning

Sexton and Hogan's (1992) recent edited work titled International psychology: Views from around the world appears to be a landmark source that offers the possibility of identifying resource personnel throughout the world who might serve as entrees to mastery learning research not yet recognized via data bases mentioned earlier. In this regard, several entries in the book are authored by psychologists whose discussions of educational psychology, school psychology, developmental psychology, psychometrics, and/or teacher education in various European countries could very well lead to an expanded network of researchers and practitioners whose work perhaps relates to the issues inherent in mastery learning. These authors and their national affiliations (not reflecting some of the more recent geopolitical changes in national boundaries and names) are as follows: G. Guttman and S. C. Etlinger--Austria; G. d'Ydewalle--Belgium; D. Kovac--Czechoslovakia; P. Niemi--Finland; A. A. Sanches--France; A. Kossakowski--German Democratic Republic; J. Groebel--Germany; L. Houssiadas--Greece; J. Laszlo and C. Plek--Hungary; T. Brady and J. McLoone--Ireland; A. L. Comunian--Italy; H. M. van der Ploeg--The Netherlands; H. Klove--Norway; Z. Chlewinski--Poland; M. Grigoroiu-Serbanescu--Romania; H. Carpintero--Spain; R. Burckhardt and R. Droz--Switzerland; G. Y. H. Vassaf--Turkey; L. F. Lowenstein--United Kingdom; and V. Pecjak--Yugoslavia.

### Recommendations for Advancing Mastery Learning Efforts in Europe

A prospective view of mastery learning in the European research community might very well incorporate the following two initiatives: (a) enhancing the use of communication networks and (b) expanding geographic locations and topical areas of impact.

#### Enhancing the Use of Communication Networks

Currently available communication networks that represent potential sources of information on mastery learning specific to the European research community need to be coordinated and utilized more fully. Particular networks referred to here include--but are not limited to--the British Education Index, the Bulletin signaletique des Sciences de l'Education in France, EUDISED, the European Association for Research on Learning & Instruction (EARLI), and national professional organizations specific to the various European nations. Other options that exist and need to be explored more extensively are the foreign affiliate membership rosters of major professional organizations wherein mastery learning has had a consistent forum (e.g., AERA

and APA) as well as the membership of international organizations such as the International Council of Psychologists (ICP) and the International Association of Applied Psychology (IAAP). Also of importance is the current effort to establish an International Society for Mastery Learning (see Hymel & Dyck, 1992, 1993) that would sponsor forums both in printed form (e.g., quarterly newsletter and/or journal) and as biennial conferences (e.g., in affiliation with existing organizations such as AERA, APA, EARLI, ICP, and/or IAAP). This proposed professional society would likewise function as an international data base or repository for identifying, housing, consolidating, and monitoring mastery learning efforts worldwide.

#### Expanding Locations & Topics of Focus

As a consequence of the communication networks discussed above, another prospective feature of mastery learning in the European community is that of initiatives focused on expanding those geographic locations and topical areas impacted by mastery learning efforts. A major impetus for this prognosis is found in the reality of professional organizations becoming more internationally sensitive (see Perkins, 1985) and, consequently, the heightened attention given to cross-cultural issues (see: Berry, Poortinga, Segall, & Dasen, 1992; Brislin, 1990) considered from a multidisciplinary standpoint. This anticipated "migration" to nations and topical areas not previously included in the mastery learning movement would presumably avoid unnecessary overlap while accommodating those locations and topics that have been omitted in the past for whatever reasons.

## References

- Anderson, L. W. (1981). A functional analysis of mastery learning. Outcomes, 1(2), 1-3.
- Anderson, L. W., & Block, J. H. (1985). Mastery learning model of teaching and learning. In T. Husen & T. N. Postlethwaite (Eds.), The international encyclopedia of education: Research and studies (Vol. 6) (pp. 3219-3230). New York: Pergamon Press.
- Arblaster, G. R. (1991). Same-age tutoring, mastery learning, and the mixed ability teaching of reading. School Psychology International, 12(1-2), 111-118.
- Ardila, R. (1982). International psychology. American Psychologist, 37, 323-329.
- Backler, A. (1979). Mastery learning: A case study and implications for instruction. J. Geogr. High. Educ., 3(1), 68-75.
- Berry, J. W., Poortinga, Y. H., Segall, M. H., & Dasen, P. R. (1992). Cross-cultural psychology: Research and applications. New York: Cambridge University Press.
- Block, J. H. (Ed.). (1971). Mastery learning: Theory and practice. New York: Holt, Rinehart, & Winston.
- Block, J. H. (1980). Promoting excellence through mastery learning. Theory Into Practice, 19, 66-74.
- Block, J. H. (1985). Belief systems and mastery learning. Outcomes, 4(2), 1, 4-14.
- Block, J.H., & Burns, R. B. (1976). Mastery learning. In L. S. Shulman (Ed.), Review of research in education (4th ed.) (pp. 3-49). Itasca, IL: F. E. Peacock, Inc.
- Bloom, B. S. (1968). Learning for mastery. Evaluation Comment, 1(2). [Unpaginated]
- Bloom, B. S. (1971). Individual differences in school achievement: A vanishing point? (A Phi Delta Kappa Monograph). Bloomington, IN: Phi Delta Kappa International.
- Bloom, B. S. (1976). Human characteristics and school learning. New York: McGraw-Hill.

- Bloom, B. S. (1978). New views of the learner: Implications for instruction and curriculum. Educational Leadership, 35, 563-568, 570-576.
- Bloom, B. S. (1980). The new direction in educational research: Alterable variables. Phi Delta Kappan, 61,(6), 382-385.
- Boonstra, H. H. (nd). Geef me de (leer) tijd. [Give me the (learning) time.] De Lier: Academisch Boeken Centrum.
- Brislin, R. W. (Ed.). (1990). Applied cross-cultural psychology (Vol. 14 of the Cross-Cultural Research & Methodology Series). Newbury Park, CA: Sage Publications.
- Carroll, J. B. (1963). A model of school learning. Teachers College Record, 64, 723-733.
- Collins, B. (1978). The effects of mastery learning and student tutors upon achievement in an audio-tutorial college biology program. J. Biol. Educ., 12(1), 27-32.
- Council of Europe. (1974). Compensatory education workshop documents (Strasbourg, October 7-11, 1974). Strasbourg, France: Author, Documentation Center for Education in Europe. (ERIC Document Reproduction Service No. ED 121 419)
- Creemers, B. P. M. (1976, October). The project: Education and social environment, Rotterdam (The Netherlands) Paper presented at the annual meeting of the International Management Training for Educational Change, Los Angeles. (ERIC Document Service Reproduction No. ED 215 041)
- Dahllof, U. (1978). Curriculum evaluation, frame factors and teaching for mastery (Uppsala Reports on Education 2). Sweden: Uppsala University, Institute of Education. (ERIC Document Reproduction Service No. ED 167 492)
- de Gruijter, D. N. (1985). Compromise models for establishing examination standards. Journal of Educational Measurement, 22(4), 263-269.
- Drever, A. (1987). Mastery learning in the secondary school: A report of school based research (Stirling Educational Monograph No. 17). Stirling, Scotland: University of Stirling, Department of Education.
- Dyck, W. E. (1976). Geschiktheid en selectie in het universitair onderwijs. [Aptitude and selection for university]. Doctoral dissertation, University of Antwerp, Antwerp, Belgium.

- Dyck, W. E., & Vanden Berghe, D. A. R. (1975). Formatieve zelfevaluatie. Culemborg, The Netherlands: Tjeenk Willink/Noorduijn.
- Dyck, W. E., & Wellens, J. (1979). Een opkomend instructieparadigma: Beheersingsleren. [An emerging instructional paradigm: Mastery learning]. Persoon en Gemeenschap, 31, 180-190.
- Dyck, W. E., & Wouters, P. (1989). A peculiar evaluation of Belgian teacher education programs. Outcomes, 8(2), 50-54.
- Dyck, W. E., Van de Looverbosch, M., & Wouters, P. (1982, March). Improving the effectiveness of undergraduate education: An experience from a Belgian university. Paper presented at the annual meeting of the American Educational Research Association, New York. (ERIC Document Reproduction Service No. ED 219 011)
- Fishbein, S. (1979). Heredity-environment influences on growth and development during adolescence: A longitudinal study of twins (Studies in Education and Psychology 4). Stockholm, Sweden: Stockholm School of Education, Department of Educational Research. (ERIC Document Reproduction Service No. ED 183 615)
- Flammer, A. (1973). Individuelle differenzen im lernen nach der mastery learning strategie. Zeitschrift fur Experimentelle und Angewandte Psychologie, 20(4), 529-546.
- Gains, C. W. (1976). Mastery learning and its implications for remedial teachers. Rem. Educ., 11, 25-26, 31.
- Guskey, T. R., & Gates, S. L. (1986). Synthesis of research on the effects of mastery learning in elementary and secondary classrooms. Educational Leadership, 43, 73-80.
- Guskey, T. R., & Pigott, T. D. (1988). Research on group-based mastery learning programs: A meta-analysis. The Journal of Educational Research, 81(4), 197-216.
- Hermann, G. D. (1986). Self-pacing in post-school education/training. Vocational Aspect of Education, 28(99), 7-16.
- Hymel, G. M. (1982). Mastery learning: A comprehensive bibliography (2nd ed.). New Orleans: Clearinghouse on Mastery Learning, Loyola University.

- Hymel, G. M. (1990, April). Harnessing the mastery learning literature: Past efforts, current status, and future directions. Paper presented at the annual meeting of the American Educational Research Association, Boston.
- Hymel, G. M. (1991). AERA's SIG/mastery learning since its inception (1981-1991): A 10-year retrospective-prospective view. Outcomes, 10(3), 24-33.
- Hymel, G. M., & Dyck, W. E. (1992, July). An international perspective on mastery learning. Paper presented at the 25th International Congress of Psychology, Brussels, Belgium.
- Hymel, G. M., & Dyck, W. E. (1993, April). The internationalization of Bloom's learning for mastery: A 25-year retrospective-prospective view. Paper presented at the annual meeting of the American Educational Research Association, Atlanta.
- Johnstone, R., Mitchell, R. F., & Parkinson, B. (1980). Mastery learning in modern languages. Mod. Lang. Scot., (20), 88-100.
- Kulik, C. C., Kulik, J. A., & Bangert-Drowns, R. L. (1990). Effectiveness of mastery learning programs: A meta-analysis. Review of Educational Research, 60(2), 265-299.
- Kulik, J. A., Kulik, C. C., & Cohen, P. A. (1979). A meta-analysis of outcome studies of Keller's personalized system of instruction. American Psychologist, 34, 307-318.
- Lahdes, E. (1983). Mastery learning in theory and in practical innovation. Scandinavian Journal of Educational Research, 27(2), 89-107.
- Langeheine, R. (1992, April). State mastery learning: Dynamic models for longitudinal data. Paper presented at the annual meeting of the American Educational Research Association, San Francisco.
- Leith, G. O. M. (1983). Whatever happened to programmed instruction, mastery learning, and microteaching: Some reflections on a neglected area of educational technology. In A. Trott, H. Strongman, & L. Giddens' (Eds.), Improving efficiency in education and training (pp. 11-23). London: Kogan Press.
- Mercer, D. (1986). Mastery learning. British Journal of In-Service Education, 12(2), 115-118.

- Miller, K., Norton, K., & Servant, D. M. (1979). A mastery learning scheme. Educ. Chem., 16(4), 109-111.
- Morrison, H. C. (1926). The practice of teaching in the secondary schools. Chicago: University of Chicago Press.
- Parkinson, B. L., Mitchell, R. F., & Johnstone, R. M. (1983). Mastery learning in modern languages--a case study. PLET, 20(1), 43-53.
- Peacock, C. (1981, July). Reading and writing at foundation level: A mastery learning approach. Paper presented at the annual meeting of the United Kingdom Reading Association, Edinburgh, Scotland. (ERIC Document Reproduction Service Number ED 208 400)
- Pennycuick, D. B., & Murphy, R. J. L. (1986). Mastery, validity and comparability issues in relation to graded assessment schemes. Studies in Educational Evaluation, 12, 305-311.
- Perkins, J. A. (1985). International council for educational development (ICED). In T. Husen & T. N. Postlethwaite (Eds.), The international encyclopedia of education: Research and studies (Vol. 5) (pp. 2657-2659). New York: Pergamon Press.
- Reezigt, G. J., & Weide, M. G. (1990, April). The effects of group-based mastery learning on language and arithmetic achievement and attitudes in primary education in the Netherlands. Paper presented at the annual meeting of the American Educational Research Association, Boston. (ERIC Document Reproduction Service No. ED 317 584)
- Sandrin, J. V. (1990). Readiness for individualization and mastery learning: An assessment of educational beliefs among three groups of educators. Germany: Department of Defense Dependents Schools (DODDS) Germany Region. (ERIC Document Reproduction Service No. ED 317 505)
- Sexton, V. S., & Hogan, J. D. (Eds.). (1992). International psychology: Views from around the world. Lincoln, NE: University of Nebraska Press.
- Shale, D., & Cowper, D. (1982). A computer-based support system for mastery instruction. Assessment and Evaluation in Higher Education, 7(2), 167-180.

- Skaalvik, E. M. (1975). An evaluation of mastery learning. Scandinavian Journal of Educational Research, 19(2), 59-74.
- Slavenburg, J. H., & Peters, T. A. (Eds.). (1989). Het project onderwijs en sociaal milieu: een eindbalans. [The project: Education and social milieu.] Rotterdam: School Advies Dienst.
- Spencer, K. (1990). HyperHeart--does animated illustration contribute to mastery learning? British Journal of Educational Technology, 21(3), 227-228.
- Straker, N. (1988). Interactive video: A cost-effective model for mathematics and science classrooms. British Journal of Educational Technology, 19(3), 202-210.
- Sumner, R. (1975). Mastery learning: An all or nothing? Res. Intell., 1(2), 24-26.
- Thomas, R. M. (1985). Individualized instruction. In T. Husen & T. N. Postlethwaite (Eds.), The international encyclopedia of education: Research and studies (Vol. 5) (pp. 2446-2451). New York: Pergamon Press.
- van der Linden, W. J. (1987). Applications of decision theory to test-based decision making (Project Psychometric Aspects of Item Banking No. 23; Research Report 87-9). Enschede, The Netherlands: Twente University, Department of Education. (ERIC Document Reproduction Service No. ED 309 189)
- Vos, H. J. (1988). Simultaneous optimization of decisions using a linear utility function (Research Report 88-15). Enschede, Netherlands: Twente University, Department of Education. (ERIC Document Reproduction Service No. ED 310 127)
- Warries, E. (1974, April). Standard mastery curves and skew curves. Paper presented at the annual meeting of the American Educational Research Association, Chicago. (ERIC Document Reproduction Service No. ED 091 422)
- Warries, E. (Ed.). (1979). Beheersingsleren een leerstrategie. Netherlands: Wolters-Noordhoff by Groningen.
- Washburne, C. W. (1922). Educational measurements as a key to individualizing instruction and promotions. Journal of Educational Research, 5, 195-206.
- Weeda, W. C. (1982). Beheersingsleren: Het model getoetst in de tijd. [Mastery learning: The model tested in time.] Doctoral dissertation, Catholic University of Tilburg.

Whiting, J. (1982). Cognitive assessment and student attitude. Assessment and Evaluation in Higher Education, 7(1), 54-73.

Whiting, J. (1984). Cognitive and student assessments of a CAL package designed for mastery learning. Comput. Educ., 8(1), 59-67.