The Critical Importance of Retrieval for Learning

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Learning is often considered complete when a student can produce the correct answer to a question. In our research, students in one condition learned foreign language vocabulary words in the standard paradigm of repeated study-test trials. In three other conditions, once a student had correctly produced the vocabulary item, it was repeatedly studied but dropped from further testing, repeatedly tested but dropped from further study, or dropped from both study and test. Repeated studying after learning had no effect on delayed recall, but repeated testing produced a large positive effect. In addition, students' predictions of their performance were uncorrelated with actual performance. The results demonstrate the critical role of retrieval practice in consolidating learning and show that even university students seem unaware of this fact.

Ever since the pioneering work of Ebbinghaus (1), scientists have generally studied human learning and memory by presenting people with information to be learned in a study period and testing them on it in a test period to see what they retained. When this procedure occurs over many trials, an exponential learning curve is produced. The standard assumption in nearly all research is that learning occurs while people study and encode material. Therefore, additional study should increase learning. Retrieving information on a test, however, is sometimes considered a relatively neutral event that measures the learning that occurred during study but does not by itself produce learning. Over the years, researchers have occasionally argued that learning can occur during testing (2–6). However, the assumptions that repeated studying promotes learning and that testing represents a neutral event that merely measures learning still permeate contemporary memory research as well as contemporary educational practice, where tests are also considered purely as assessments of knowledge.

Our goal in the present research was to examine these long-standing assumptions regarding the effects of repeated studying and repeated testing on learning. Specifically, once information can be recalled from memory, what are the effects of repeated encoding (during study trials) or repeated retrieval (during test trials) on learning and long-term retention, assessed after a week delay? A second purpose of this research was to examine students' assessments of their own learning. After learning a set of materials under repeated study or repeated test conditions, we asked students to predict their future recall on the week-delayed final test. Our question was, would students show any insight into their own learning?

A final purpose of the experiment was to address another venerable issue in learning and memory, concerning the relation between the speed with which something is learned and the rate at which it is forgotten. Is speed of learning correlated with long-term retention, and if so, is the correlation positive (processes that promote fast learning also slow forgetting and promote good retention) or negative (quick learning may be superficial and produce rapid forgetting)? Early research led to the conclusion that quick learning reduced the rate of forgetting and improved long-term retention (7), but later critics argued that, when forgetting is assessed more properly than in the early studies, no differences exist between forgetting rates for fast and slow learning conditions (8, 9). By any account, conditions that exhibit equivalent learning curves should produce equivalent retention after a delay (9).

Using foreign language vocabulary word pairs, we examined the contributions of repeated study and repeated testing to learning by comparing a standard learning condition to three dropout conditions. The standard method of measuring learning, used since Ebbinghaus's research (1), involves presenting subjects with information in a study period, then testing them on it in a test period, then presenting it again, testing on it again, and so on. The dropout learning conditions of the present experiment differed from the standard learning condition in that, once an item was successfully recalled once on a test, it was either (i) dropped from study periods but still tested in one condition, (ii) dropped from test periods but still repeatedly studied in a second condition, or (iii) dropped altogether from both study and test periods in a third condition (Table 1).

Surprisingly, standard learning conditions and dropout conditions have seldom been compared in memory research, despite their critical importance to theories of learning and their practical importance to students (in using flash cards and other study methods). Dropout conditions were originally developed to remedy methodological problems that arise from repeated practice in the standard learning condition (10), but they can also be used to examine the effect of repeated practice in its own right, as we did in the present experiment. If learning happens exclusively during study periods and if tests are neutral assessments, then additional study trials should have a strong positive effect on learning, whereas additional test trials should produce no effect. Further, if repeated study or test practice after an item has been learned does indeed benefit long-term retention, this would contradict the conventional wisdom that students should drop material that they have learned from further practice in order to focus their effort on material they have not yet learned. Dropping learned facts may create the same long-term retention as occurs in standard conditions but in a shorter amount of time, or it may improve learning by allowing students to focus on items they have not yet recalled. This strategy is implicitly endorsed by contemporary theories of study-time allocation (11, 12) and is explicitly encouraged in many popular study guides (13).

Table 1. Conditions used in the experiment, average number of trials within each study or test period, and total number of trials in the learning phase in each condition. S_N indicates that only vocabulary pairs not recalled in the previous test period were studied in the current study period. T_N indicates that only pairs not recalled in the previous test period were tested in the current test period. Students in all conditions performed a 30-s distracter task that involved verifying multiplication problems after each study period.

Condition	Study (S) or test (T) period and number of trials per period								Total number of trials
	1	2	3	4	5	6	7	8	
ST	S 40	T 40	S 40	T 40	S 40	T 40	S 40	T 40	320
S_NT	S 40	T 40	S_N 26.8	T 40	S_N 8.0	T 40	S_N 2.0	T 40	236.8
ST_N	S 40	T 40	S 40	T_N 27.9	S 40	T_N 11.8	S 40	T_N 3.3	243.0
$S_N T_N$	S 40	T 40	S_N 27.1	T_N 27.1	S_N 8.8	T_N 8.8	S_N 1.5	T_N 1.5	154.8

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The Critical Importance Of Retrieval For Learning

David G. Myers

The Critical Importance Of Retrieval For Learning:

Supporting Children and Young People with Test Anxiety in School Helen Barsham,2025-11-28 This accessible and informative book provides educators with a unique approach to supporting children and young people with test anxiety combining key research and practical guidance to improve wellbeing and test outcomes The book focuses on three core areas for promoting wellbeing test anxiety theory desirable difficulties and self efficacy theory Underpinning research is presented in an accessible format and each topic is explored in depth with case studies and reflection points to deepen understanding and bring theory to life Chapters go on to introduce an innovative easy to implement intervention The intervention focuses on increasing children s metacognition of their own learning from how memory works to knowing how to revise lowering anxiety around high stakes exams and boosting overall wellbeing and ultimately academic success Including a wealth of examples and tips for tangibly supporting children and young people s learning outcomes this book is a crucial read for Special Educational Needs Coordinators SENCOs teachers and anyone with responsibility for the pastoral care and wellbeing of young people *The Learning Skills Cycle* William R. Klemm,2017-03-01 This book s ideas demonstrate how students are not adequately taught the learning skills necessary for superior academic achievement The major reason schools are failing is that there is less emphasis on teaching students how to learn the focus is on what to learn instead This book provides teachers and parents with many concepts and tactics that they can use to teach children how to learn more efficiently and effectively This book identifies and explains those skills and frames them as interacting in a mutually interacting and reinforcing cycle that I call the Learning Skills Cycle **Research Methods Pedagogy: Engaging Psychology Students in Research Methods and Statistics** Lynne Roberts,2016-11-09 Research methods and statistics are central to the development of professional competence and evidence based psychological practice Noun masculine research on the development of psychological literacy Despite this many psychology students express little interest in and in some cases of active dislike of learning research methods and statistics This ebook brings together current research innovative evidence based practice and critical discourse **Computer Supported Education** H. Chad Lane,Susan Zvacek,James Uhomoibhi,2020-11-09 This book constitutes the thoroughly refereed proceedings of the 11th International Conference on Computer Supported Education CSEDU 2019 held in Heraklion Crete Greece in May 2019 The 30 revised full papers were carefully reviewed and selected from 202 submissions The papers cover wide research fields including authoring tools and content development AV communication and multimedia classroom management e Learning hardware and software blended learning critical success factors in distance learning *International Perspectives in Online Instruction* Jaimie Hoffman,Patrick Blessinger,2021-11-04 Focusing on effective practices in online teaching this volume of Innovations in Higher Education Teaching and Learning begins with discussing the use of videos in online teaching and then pivots to consider methods for supporting and managing faculty who teach online **Assessment in Singapore: Strategies and**

methods for classroom practice Poh Guan Toh,See Cheng Leong,2014   Psychology Daniel L. Schacter,Daniel T. Gilbert,Daniel M. Wegner,2010-12-10 Your students may forget it s a textbook But they will always remember what they learn View a sample chapter and student video reviews at www worthpublishers com thedans Their research continues to change the way psychology is taught Their teaching has inspired thousands of students Their writing fascinates readers and vividly shows how psychological science is relevant to their lives So it was no surprise that Dan Schacter Dan Gilbert and Dan Wegner s introductory psychology textbook was a breakout success With the new edition Psychology is more than ever a book instructors are looking for a text that students will read and keep reading Thoroughly updated the new edition is filled with captivating stories of real people and breakthrough research plus a variety of proven and effective new learning tools all carried along by the Dans uncanny way of making the story of psychological principles as riveting and enriching as reading a great book   **Science** John Michels (Journalist),2008   **Psychology in Everyday Life** David G. Myers,2014-01-20 David Myers briefest introduction to psychology speaks to all students regardless of their background or level of preparedness with no assumptions made in the vocabulary examples or presentation Students of all kinds are comfortable with Myers manageable chapters which include careful connections to associated visuals comparative tables and research based pedagogy For this edition there is something completely new to a Myers text David Myers personally selected new coauthor Nathan DeWall s enthusiasm for teaching and writing about psychological science makes him uniquely suited to join the worlds bestselling psychology textbook author And with about 30 more pages of coverage this edition has become an even stronger and more complete introduction to the science of psychology for courses of all kinds   **Introducing Psychology** Daniel L. Schacter,Daniel T. Gilbert,Daniel M. Wegner,2012-09-15 Instructor and student evaluations from coast to coast attest to the Dans captivating writing These award winning bestselling authors know how to enthrall students with the subject they love best psychology But in the new edition of Introducing Psychology they go even further to ensure that students won t commit one of the seven sins of memory forgetting what they just read Special Cue Questions and Critical Thinking questions give students the opportunity to process psychological concepts and aid their understanding and memory And if you ve ever heard someone parrot a widespread misconception you ll welcome the new Changing Minds questions short scenarios which ask students to confront common misunderstandings of psychological phenomena Now the book that students love to read is as unforgettable as ever   **Cognitive Modeling in Perception and Memory** J G W Raaijmakers,Robert Goldstone,Mark Steyvers,Amy Criss,Robert Nosofsky,2015-02-11 The work of Richard M Shiffrin has highly impacted the field of cognitive science and current developments within perception and memory have been influenced by his ideas In this volume several key figures in the field will comment on these developments and put them in a wider perspective Although many theories and models have been presented in recent years for various aspects of human cognition there have not been many comparative evaluations that focus on how these models have really advanced our understanding

of the underlying mechanisms This volume will be a valuable source of information for both cognitive scientists working in the field and researchers and students looking for a clear accessible presentation of the key problems in cognitive science Highlighted sections include attention and perception memory functions and processes knowledge representation and semantics modelling approaches and applications **Biological Psychology** S. Marc Breedlove,Neil Verne Watson,Mark R. Rosenzweig,2010 The new edition boasts hundreds of new references including research students may have encountered in the popular media Yet critical thinking skills are also honed as the reader is alerted to the many widely held myths about the neuroscience of behavior and educated about facts that sound unlikely to the uninformed Thorough and reader friendly Biological Psychology reveals the fascinating interactions of brain and behavior KEY FEATURES The book has an outstanding full color art program including hundreds of original illustrations that make it easy to understand structures mechanisms and processes in the brain Each chapter opens with a brief outline and a narrative illustrating an important aspect of behavioral biology that will be made clear to the student by reading the rest of the chapter Redesigned chapter summaries are organized by main chapter heads in a readable two column format **Psychology** David G. Myers,2011-12-25 David Myers bestselling Psychology has reached a wider audience of students and instructors with each new edition Myers and his team lead the field in being attuned to psychology s research and the needs of the instructors and students in the course today Ten million student class testers and thousands of adopting instructors can attest to the quality of this project True to form this landmark new Tenth Edition is another vigorous deeply considered revision *Readings for Diagnostic and Remedial Reading* Robert Mills Wilson,1972 **Animal Behaviour Abstracts** ,1989 Combined Proceedings American Marketing Association,1975 Marketing in Turbulent Times and Marketing, the Challenges and the Opportunities American Marketing Association,1975 **Language and Language Behavior Abstracts** ,1971 **Neuropsychological Assessment** Muriel Deutsch Lezak,1983 Significant new insights and research findings about brain behavior relationships neurological disorders neurodiagnostic issues and neuropsychological assessment procedures are incorporated into the third edition of Neuropsychological Assessment Preliminary chapters present the principles necessary for a patient oriented personalized hypothesis testing approach to neuropsychological assessment The subsequent chapters contain nearly all of the tests and assessment techniques covered in the previous editions plus many additional ones including newly developed neuropsychological tests tests from other branches of psychology research techniques that have only recently been introduced into clinical neuropsychology tests originating in Europe and elsewhere and a few measures as yet untried by neuropsychologists In a reorganization designed to meet current thinking and assessment procedures tests originally offered in prepackaged batteries are now presented within their appropriate functional domains For example individual memory tests whether developed singly or for use in a commercial battery are discussed in the chapter on memory tests while a new chapter deals with memory batteries questionnaires and inventories A separate chapter reviews prepackaged and

commercial test batteries used for general purpose neuropsychological assessment but the individual tests from these batteries are treated elsewhere according to the salient functions they examine Following chapters on observational measurement techniques and on measures of personality and emotional status the concluding chapter presents an array of techniques that have been used to identify motivational problems and malingering **Teach Your Very Best** Barnabas Otaala,Fred Opali,2002

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