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Assessing Multiplicative Thinking Using Rich Tasks

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Recent research has identified multiplicative thinking as a major barrier to students' mathematical progress in the middle years of schooling. New approaches to assessment are needed to inform more targeted teaching and improve student numeracy outcomes at this level. The purpose of this paper is to describe the processes involved in developing a range of rich assessment tasks to evaluate students' multiplicative thinking in Years 4 to 8. Key concepts used as a basis for designing the tasks, as well as the tasks, scoring rubrics, and assessment protocols used to collect data from just under 3500 students will be illustrated, together with sample student responses.

Background:

The material presented in this paper is drawn from a recently completed research project aimed at scaffolding numeracy learning in the middle years of schooling¹. The project was prompted by the results of an earlier study which indicated that many students in Years 5 to 9 have difficulty with what might broadly be described as multiplicative thinking. That is, thinking that is characterised by

- (i) a capacity to work flexibly and efficiently with an extended range of numbers (for example, larger whole numbers, decimals, common fractions, and/or per cent);
- (ii) an ability to recognise and solve a range of problems involving multiplication or division including direct and indirect proportion; and
- (iii) the means to communicate this effectively in a variety of ways (for example, words, diagrams, symbolic expressions, and written algorithms).

In particular, the results suggest that while most students are able to solve multiplication problems involving relatively small whole numbers, they rely on additive strategies to solve more complex multiplicative problems involving larger whole numbers, rational numbers, and/or situations not easily modelled in terms of equal groups (Siemon & Virgona, 2001). This suggests that the transition from additive to multiplicative thinking is nowhere near as smooth or as straightforward as most curriculum documents seem to imply, and that access to multiplicative thinking, as it is described here, represents a real and persistent barrier to many students' mathematical progress in the middle years of schooling.

This observation is supported by the literature more generally. For example, there is a considerable body of research pointing to the difficulties students experience with multiplication and division (Mulligan & Mitchelmore, 1997; Anghileri, 1999), and the relatively long period of time needed to develop these ideas (Clark & Kamii, 1996; Sullivan, Clarke, Cheeseman & Mulligan, 2001). Student's difficulties with rational number and proportional reasoning have also been well documented (for example, Hart, 1981; Harel & Confrey, 1994; Lamon, 1996; Baturo, 1997; Misailidou & Williams, 2003). Moreover, there is a growing body of research documenting the link between multiplicative thinking and rational number ideas (Harel & Confrey, 1994; Baturo, 1997); multiplicative thinking and spatial ideas (Battista, 1999), and the importance of both as a basis for understanding algebra (Gray & Tall, 1994). While this work contributes to a better understanding of the 'big ideas' involved, very little is specifically concerned with how these ideas relate to one another and which aspects might be needed when, to support new learning both within and

¹ *Scaffolding numeracy in the Middle Years – An investigation of a new assessment-guided approach to teaching mathematics using authentic assessment tasks 2003-2006*, an ARC Linkage Research Project awarded to RMIT University in collaboration with the Victorian Department of Education & Training, and the Tasmanian Department of Education

Kswriting Tasks 2003

Lorraine Wilson



Kswriting Tasks 2003:

Teaching L2 Composition Dana R. Ferris, John Hedgcock, 2013-10-01 This popular comprehensive theory to practice text is designed to help teachers understand the task of writing L2 writers the different pedagogical models used in current composition teaching and reading writing connections Moving from general themes to specific pedagogical concerns it includes practice oriented chapters on the role of genre task construction course and lesson design writing assessment feedback error treatment and classroom language grammar vocabulary style instruction Although all topics are firmly grounded in relevant research a distinguishing feature of the text is the array of hands on practical examples materials and tasks that pre and in service teachers can use to develop the complex skills involved in teaching second language writing Each chapter includes Questions for Reflection Further Reading and Resources Reflection and Review and Application Activities An ideal text for L2 teacher preparation courses courses that include both L1 and L2 students and workshops for instructors of L2 writers in academic secondary and postsecondary settings the accessible synthesis of theory and research enables readers to see the relevance of the field's knowledge base to their own present or future classroom settings and student writers

Lexical Errors and Accuracy in Foreign Language Writing María Pilar Agustín Llach, 2011 This book explores how lexical competence develops in a foreign language and also argues for the importance of lexical accuracy as a measure of the quality of foreign language writing and as an indicator of receptive vocabulary knowledge

An Empirical Study of EFL Writing at Primary School Ruth Trüb, 2022-05-16 This book presents a research study investigating young foreign language learners ability to compose communicative texts in English It reviews current research on young learners EFL writing reports on the learners EFL writing competence describes text quality at different CEFR language levels and discusses current teaching practices and the learners perception of EFL writing

Teaching and Researching Chinese EFL/ESL Learners in Higher Education Zhongshe Lu, Meihua Liu, Wenxia Zhang, 2021-06-21 China has attached great importance to teaching students to become proficient users of English Yet despite a plethora of studies and practice on Chinese ESL EFL English as a second foreign language learners the large student population its complicated composition and the complex nature of second and foreign language learning have rendered it difficult to offer a panoramic view on ESL EFL teaching and learning of Chinese learners This book provides a new and up to date perspective on the teaching and learning of Chinese ESL EFL learners The book collects 15 case studies falling into two parts Curriculum Development and Teaching Practice and Skills Based Research The collected studies deploy qualitative quantitative or mixed methods to explore patterns features developments and causes and effects of a variety of issues in the sphere of ESL EFL teaching and learning Moreover the cases offer insights that are relevant beyond the mainland Chinese context such as Hong Kong Macau Britain and Australia Students and scholars of TESOL and applied linguistics will be interested in this title

Task-Based Language Learning - Insights from and for L2 Writing Heidi Byrnes, Rosa M. Manchón, 2014-11-14 The book seeks to

enlarge the theoretical scope research agenda and practices associated with TBLT in a two way dynamic by exploring how insights from writing might reconfigure our understanding of tasks and in turn how work associated with TBLT might benefit the learning and teaching of writing In order to enrich the domain of task and to advance the educational interests of TBLT it adopts both a psycholinguistic and a textual meaning making orientation Following an issues oriented introductory chapter Part I of the volume explores tenets methods and findings in task oriented theory and research in the context of writing the chapters in Part II present empirical findings on task based writing by investigating how writing tasks are implemented how writers differentially respond to tasks and how tasks can contribute to language development A coda chapter summarizes the volume s contribution and suggests directions for advancing TBLT constructs and research agendas

Analysis of Writing Activities in Korean English Textbooks Moon-Jeung Chang,2004 *Promoting Speaking and Writing Competencies in the context of Task-Supported Language Learning in Grade 8*,2022-08-31 Seminar paper from the year 2019 in the subject English Language and Literature Studies Other grade 1 3 University of Kassel language English abstract The following term paper will give an overview of the principles of task supported language learning TSLL Firstly the basic concept of a task and its meaning will be analysed Then TSLL will be further explained by using the guidelines provided by Ellis 2003 Moreover the sequencing of a task will be exemplified Following this the teacher and learner roles in the TSLL context will be investigated Furthermore the different options of task support will be elucidated Additionally the speaking and writing competencies will be elaborated on Possibilities of improving these will be mentioned The target task C11 taken from the coursebook Camden Town 4 which is used in grade 8 at grammar schools in Hesse will be analysed based on the previously mentioned aspects Ideas on how this target task could be enhanced will be offered Finally it will be embedded in the according curriculum and analysed for the competencies that are to be achieved

Writing Processes, Text Quality, and Task Effects Daphne van Weijen,2008 **Handbook of Writing Research** Charles A. MacArthur,Steve Graham,Jill Fitzgerald,2008-01-14 Presents a collection of essays discussing the theories and models of writing research Improving Students' Writing in Higher Education Abdeljalil Ohra,2020-01-14 Bachelor Thesis from the year 2019 in the subject Didactics for the subject English Grammar Style Working Technique Sultan Moulay Sliman University language English abstract The present study generally aims to enlighten some possible ways and strategies that could help academic learners of EFL to improve their writing levels To state these ways the questionnaire is used to collect data and it was distributed to participants in S2 and S6 in order to know whether there is some improvement or not Yet the researcher employed mixed methods since both quantitative and qualitative methods are required to collect data The findings of this research revealed that students writing still needs improvement Finally the results of this monograph may urge students to ameliorate their writing skill Writing is a component of language skill which occurs after speaking In addition it provides a relatively permanent record of information opinions beliefs feelings arguments explanations theories etc Writing also allows us to share communication not only with our

contemporaries but also with future generations as well as it permits people from the near and far distance past to speak to us In fact it is the official element for the development of printed documents books and Internets Therefore writing is the best supportive tool for us and it plays an important role in our life *Bibliographic Guide to Education 2003* GK Hall,2004-10 The Bibliographic Guide to Education lists recent publications cataloged during the past year by Teachers College Columbia University supplemented by publications in the field of education cataloged by The Research Libraries of The New York Public Library selected on the basis of subject headings Non book materials including theses are included in this Guide with the exception of serials All aspects and levels of education are represented in this Guide including such areas as American elementary and secondary education higher and adult education early childhood education history and philosophy of education applied pedagogy international and comparative education educational administration education of the culturally disadvantaged and physically handicapped nursing education and education of minorities and women Also well covered are the administrative reports of departments of education for various countries and for U S states and large cities The Teachers College collection covers over 200 distinct educational systems Works in all languages are included The Bibliographic Guide to Education serves in part as an annual supplement to the Dictionary Catalog of the Teachers College Library Columbia University G K Hall Second Supplement 1973 Third Supplement 1977 Early Learning of Modern Foreign Languages Marianne Nikolov,2009 Modern languages are offered to young learners at an increasingly early age in many countries yet few publications have focused on what is available to children in different contexts This volume fills this gap by documenting the state of the art in researching young language learners using a variety of research methods It demonstrates how young children progress and benefit from an early exposure to modern languages in different educational contexts and how affective cognitive social linguistic and classroom related factors interact in the processes A special strength is the range of languages although English is the most widely learnt language chapters focus on various target languages Croatian French English German Italian Spanish and Ukrainian and the contexts include China Croatia Greece Hungary Ireland Norway Poland the Ukraine and the United Kingdom **Magruder's American Government Guided Reading and Review Workbook Student Edition 2003c** William A. McClenaghan,2002-05-15 High School Hailed as a stellar educational resource for nearly a century Magruder s American Government is updated annually to meet the changing needs of today s high school students and teachers The program s engaging narrative is enhanced with numerous primary sources political cartoons charts graphs and photos making the structure and principals of government accessible and motivating to students of all abilities **Writing and Speech Recognition** Mariëlle Leijten,2007 **Instructional Methods for Secondary Students with Learning and Behavior Problems** Patrick J. Schloss,Cynthia N. Schloss,2007 This book presents teaching principles useful to general high school educators and special educators working with students demonstrating a variety of academic behavioral and social needs in secondary schools Instructional Methods for Adolescents

with Learning and Behavior Problems continues to fill a void in the textbook arena by presenting a comprehensive package of teaching techniques useful in helping secondary special educators develop and implement instruction that is appropriate for all students. The diversity of the needs of secondary students with disabilities and the challenge of providing appropriate educational services in general education settings places unique demands on students and their teachers and this text provides much needed information and support.

Academic Writing Mary Kay Mulvaney, David A. Jolliffe, 2005. This unique interdisciplinary text and reader introduces students to the multiple genres of academic writing across the curriculum. Academic Writing is the first text to offer a discussion of academic genres and writing to learn and learning to write in college; an explanation of genre practices and conventions across the disciplines; annotated examples of student papers across the disciplines written in response to actual college assignments; instruction in research writing from sources and documentation; and thematic clusters of professional readings as engaging examples of published academic writing. Academic Writing will prepare students in all academic disciplines to succeed in today's challenging world of writing both in the classroom and in the workplace beyond.

Preparation for State-mandated Testing David J. Johnson, 2005.

World Explorer Europe and Russia 3 Edition Student Edition 2003c, 2002.

Teach Writing to Older Readers Using Picture Books Jane Heitman, Jane Heitman Healy, 2005. Presents more than one hundred standards based lessons for fifth to ninth graders that use picture books to teach about literary elements including characters, setting, plot, theme, and style.

Writing to Live Lorraine Wilson, 2006. I recommend this book to all teachers who teach writing. The way you teach writing will change forever. Brian Cambourne, Wollongong University. If a school reflects the beliefs of its community, then its curriculum mirrors how children are valued and what kinds of learning matter most. In some schools, well intentioned writing curriculum disengages students from their world by artificially limiting their natural zest for self expression. That's why, argues Lorraine Wilson, it's crucial that writing be structured to open students' eyes and excite them with the many possibilities that literate behaviors offer. Writing to Live specifically addresses ways to make writing curriculum relevant to students' lives while helping them develop the skills to become active, critically aware citizens. Wilson introduces a variety of contemporary research based strategies that bring writing instruction into the moment and engage students' strategies such as welcoming children to think and write about hot topics of their choice; encouraging them to bring their out of school literacies into the classroom; inviting them to explore a broad range of genres; asking students to write with purpose and answer challenging questions; promoting critical literacy techniques such as considering author purpose and values, identifying stereotypes and responding to and rewriting texts. Wilson's strategies develop children's self confidence as writers and readers while giving them an opportunity to voice concerns, express opinions and seek answers to questions of social justice. And to help you understand how her ideas work in practice, she provides a detailed account of two upper elementary classrooms where the curriculum is relevant to students' lives and activities such as writing, reading, role playing and drawing cultivate active

critically aware citizens Every community loves its children but in some places the writing curriculum doesn't nurture students in ways that help them develop into responsible decision makers Let Writing to Live be your guide and make a change for the better

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Table of Contents Kswriting Tasks 2003

1. Understanding the eBook Kswriting Tasks 2003
 - The Rise of Digital Reading Kswriting Tasks 2003
 - Advantages of eBooks Over Traditional Books
2. Identifying Kswriting Tasks 2003
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Kswriting Tasks 2003
 - User-Friendly Interface
4. Exploring eBook Recommendations from Kswriting Tasks 2003
 - Personalized Recommendations
 - Kswriting Tasks 2003 User Reviews and Ratings
 - Kswriting Tasks 2003 and Bestseller Lists
5. Accessing Kswriting Tasks 2003 Free and Paid eBooks
 - Kswriting Tasks 2003 Public Domain eBooks

- Kswriting Tasks 2003 eBook Subscription Services
- Kswriting Tasks 2003 Budget-Friendly Options
- 6. Navigating Kswriting Tasks 2003 eBook Formats
 - ePub, PDF, MOBI, and More
 - Kswriting Tasks 2003 Compatibility with Devices
 - Kswriting Tasks 2003 Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Kswriting Tasks 2003
 - Highlighting and Note-Taking Kswriting Tasks 2003
 - Interactive Elements Kswriting Tasks 2003
- 8. Staying Engaged with Kswriting Tasks 2003
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Kswriting Tasks 2003
- 9. Balancing eBooks and Physical Books Kswriting Tasks 2003
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Kswriting Tasks 2003
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Kswriting Tasks 2003
 - Setting Reading Goals Kswriting Tasks 2003
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Kswriting Tasks 2003
 - Fact-Checking eBook Content of Kswriting Tasks 2003
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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web here the value of concentration of water is taken as 0 36 instead of 0 16 divide the product of the concentration of water carbon monoxide and the equilibrium constant by the concentration of hydrogen instead of multiplying it correct d the value of K_{eq} is taken as 4 4 instead of 0 44