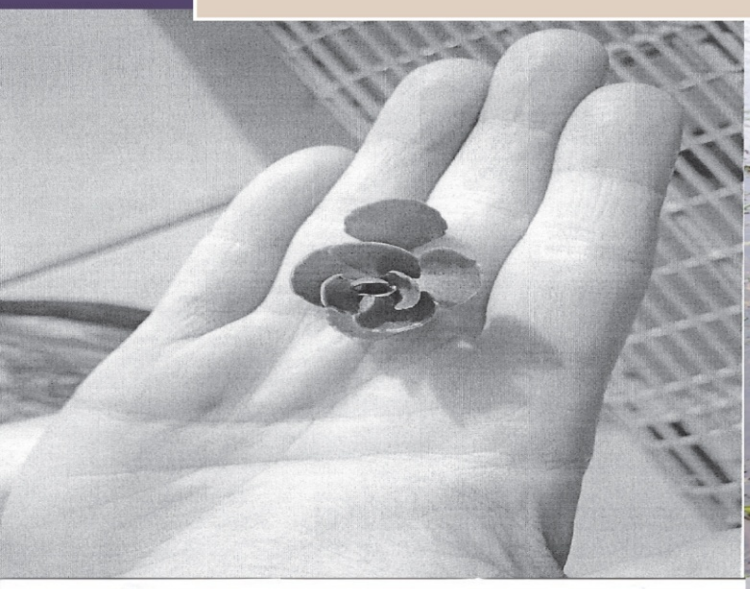
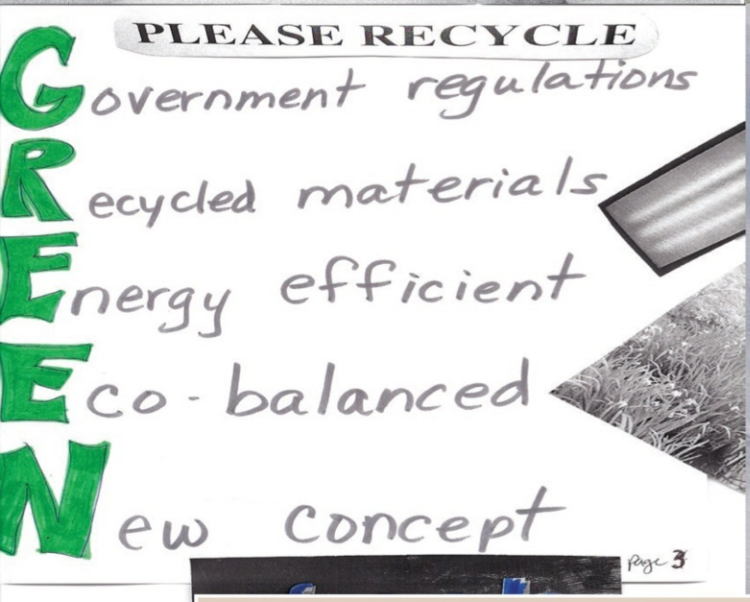
BOLD VISIONS IN EDUCATIONAL RESEARCH

Project-Based Writing in Science

Lawrence Baines





SensePublishers

Project-Based Writing in Science

Bold Visions in Educational Research
Volume 41

Series Editors:

Kenneth Tobin, *The Graduate Center, City University of New York, USA*
Carolyne Ali-Khan, *College of Education & Human Services, University of North Florida, USA*

Co-founding Editor:

Joe Kincheloe

Editorial Board:

Barry Down, *School of Education, Murdoch University, Australia*
Daniel L. Dinsmore, *University of North Florida, USA*
Gene Fellner, *Lehman College, College of Staten Island, USA*
L. Earle Reybold, *Qualitative Research Methods, George Mason University, USA*
Stephen Ritchie, *School of Education, Murdoch University, Australia*

Scope:
Bold Visions in Educational Research is international in scope and includes books from two areas: *teaching and learning to teach* and *research methods in education*. Each area contains multi-authored handbooks of approximately 200,000 words and monographs (authored and edited collections) of approximately 130,000 words. All books are scholarly, written to engage specified readers and catalyze changes in policies and practices. Defining characteristics of books in the series are their explicit uses of theory and associated methodologies to address important problems. We invite books from across a theoretical and methodological spectrum from scholars employing quantitative, statistical, experimental, ethnographic, semiotic, hermeneutic, historical, ethnomethodological, phenomenological, case studies, action, cultural studies, content analysis, rhetorical, deconstructive, critical, literary, aesthetic and other research methods.

Books on *teaching and learning to teach* focus on any of the curriculum areas (e.g., literacy, science, mathematics, social science), in and out of school settings, and points along the age continuum (pre K to adult). The purpose of books on *research methods in education* is **not** to present generalized and abstract procedures but to show how research is undertaken, highlighting the particulars that pertain to a study. Each book brings to the foreground those details that must be considered at every step on the way to doing a good study. The goal is **not** to show how generalizable methods are but to present rich descriptions to show how research is enacted. The books focus on methodology, within a context of substantive results so that methods, theory, and the processes leading to empirical analyses and outcomes are juxtaposed. In this way method is not reified, but is explored within well-described contexts and the emergent research outcomes. Three illustrative examples of books are those that allow proponents of particular perspectives to interact and debate, comprehensive handbooks where leading scholars explore particular genres of inquiry in detail, and introductory texts to particular educational research methods/ issues of interest to novice researchers.

Project-Based Writing in Science

Lawrence Baines
The University of Oklahoma

SENSE PUBLISHERS
ROTTERDAM/BOSTON/TAIPEI

A C.I.P. record for this book is available from the Library of Congress.

ISBN: 978-94-6209-669-1 (paperback)
ISBN: 978-94-6209-670-7 (hardback)
ISBN: 978-94-6209-671-4 (e-book)

Published by: Sense Publishers,
P.O. Box 21858,
3001 AW Rotterdam,
The Netherlands
https://www.sensepublishers.com/

Printed on acid-free paper

All Rights Reserved © 2014 Sense Publishers

No part of this work may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, microfilming, recording or otherwise, without written permission from the Publisher, with the exception of any material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work.

To mom, as always

Special thanks to Melanie and Anastasia for helping with the research.

TABLE OF CONTENTS

LIST OF FIGURES

FOREWORD TO LAWRENCE BAINES' PROJECT-BASED WRITING IN SCIENCE

BY DR. MICHAEL L. BENTLEY

> "If you cannot – in the long run – tell someone what you have been doing, your doing has been worthless." - Nobel Laureate Edwin Schrodinger (1951)

As a science teacher or teacher educator, you will find this a very engaging book. The first thing that came to my mind when I read it was how I would use it in my courses in elementary and secondary science teaching methods. In fact, I used a few things from the book right away, sharing with my students Chapter One's of eight essential science websites, as well as the possible writing assignments that were itemized and the "Listener Out-of-Class" worksheet. The latter accompanies Lawrence Baines' suggestion about the value of students sharing their work with people other than their teachers. After the student reads to him or her, that selected listener, or "LOC," writes down the student's responses to a few questions about the piece, and gives it back to the student to submit as his or her homework assignment. Addressing an outside audience lets the student explain one or more science concepts to someone else, and thereby develop his or her own understanding. In addition, the child's teacher escapes some of the dreaded chore of grading and gets valuable free help in providing formative assessment.

For anyone like myself who is regularly engaged in teacher preparation and credentialing and professional development courses, this book presents a well-researched argument for why writing should be emphasized as a key teaching method in science education at all levels. In addition to providing a substantial rationale for the pedagogy, Baines provides a set of five examples in different science disciplines that demonstrate specifically how writing can be used to make instruction more effective at the classroom lesson level. Better yet, these lessons represent "best practices" in science teaching because they all incorporate inquiry and active learning strategies. And certainly the various levels of writing tasks suggested in the sample lessons are all "minds-on" strategies.

This is a book that John Dewey would very much appreciate. Dewey is associated with the idea that 'we learn by doing' but his position perhaps is confused with the Chinese saying, 'I do, and I understand.' But what Dewey actually wrote was, "Give the pupils something to do, not something to learn; and the doing is of such a nature as to demand thinking; learning naturally results." So, what Dewey really means is that we learn by *thinking*. And Lawrence Baines shares with fellow educators a number of strategies to get kids to think more deeply (through writing) about the science content of the classroom curriculum. Few students will be able to resist being

engaged with the real-life scenarios and fascinating science in the sample lessons. Most of the lessons could be adapted for classroom use in upper elementary, middle and high school, and even college science classes. They are also great examples of integrating science and language arts in the classroom curriculum that teacher educators like me can use in undergraduate and graduate science methods courses and in professional development workshops.

Chapter 1 in this book describes three levels of student writing, a useful categorization for making assignments and helpful in assessing student work. The "quickwrite" is completed by students in a few minutes and represents a level one writing assignment. Baines states, "The purpose of a quickwrite may be to give students the opportunity to capture their thoughts at a particular moment in time and put them into words. Without the time to reflect, scientific concepts can quickly turn into confused notions…"

The quickwrite exercise helps students focus and reflect on the content but is usually not graded. It is also is a way for the teacher to guide student thinking in a desired direction. The next level writing assignment, level two, falls between this and a research-type paper, or term paper, which represents the level three writing assignment. As Baines notes, most writing in the science classroom is to inform or persuade a specific audience, and all requires some degree of reflection on the facts and concepts of the lesson. The level 3 is the most demanding work and usually a more long-term project.

In Chapter 2 Baines shares a number of valuable ways teachers can reduce the time normally spent grading papers, tips that most teachers will find especially helpful. He describes one teacher who only gives grades of zero or A to students on their writing assignments. While this may sound harsh, the teacher has found that students have responded well to the challenge and he has few failures. The secret strategy is how he enables students to get help from peers and other adults. From assessing student writing, a teacher can quickly grasp where comprehension is solid and where it breaks down. In this chapter Baines recommends teachers share scoring rubrics for assignments with students so that the grading criteria are up front. As one who uses rubrics in teaching, I can testify that they are very helpful in both guiding students in their work and in later justifying an evaluation to the student and to others if necessary, such as instructional supervisors and parents during parent-teacher conferences. Finally in Chapter 2, Baines discusses the National Assessment of Educational Progress and the criteria for evaluating writing used in its prestigious national assessments, criteria that can be used by science teachers in assessing student writing.

In his earlier book, *A teacher's guide to multisensory learning*, Baines (2008) wrote about the value of simulations in teaching and learning. In terms of impact, he claims that learning through simulations and models is second only to direct, physical experience, and I concur. In fact, medical training, pilot training, and military training are all dependent upon realistic simulations of what the learner will likely encounter in his or her professional practice. In Chapters 3 to 7 Baines