

## Chapter 4

### Thematic Analyses

#### Brief Review of Research Methodology

Data collected for this study included individual interview transcripts, classroom observation fieldnotes and collected documents. The participants were chemistry teachers and their students from MVGS. The research methodology involved comparisons and contrasts of interview transcripts, fieldnotes and documents to establish identification of common threads or themes within the data.

The analyses of the data began with the following seven research questions:

- 1] How do the teachers define portfolios?
- 2] How do the teachers implement portfolios in their classrooms?
- 3] How do the teachers' definitions of portfolios change during the trimester when they initially implement the procedure?
- 4] What are the students' understandings of portfolios and how they are used?
- 5] How do the students' definitions of portfolios change over the trimester?
- 6] What do teachers and students believe portfolios represent regarding the learning that occurs in the science classroom? and
- 7] What do the data collected via this study demonstrate about portfolios as a valid means of assessing student progress?

The data were sorted and coded three separate times. For the initial data sort, I read the transcripts and made notations about possible themes. I then completed an extensive second coding process by making line by line subject indexes of each transcript. When this coding was completed, I was able to identify themes by looking for notations of topics, concerns, issues, etc. that appeared repeatedly. For the third phase of this process, I compared the indexes to identify common themes or threads using the research questions as a guide. The themes I identified - definition, reflection, value, history, implementation, and change - were selected because they paralleled the research questions. Lastly, I identified each individual theme in all transcripts.

## **Metaphor Use and Data Analysis**

Metaphors are often referred to as “conceptual leaps” (Sacks, 1979). Schon (1979) describes the use of metaphors as a process that involves making new meanings or generating new frames of reference within which problems are considered. As I began to write the analysis section of my dissertation, I started to see a problem developing. In trying to describe my findings to others, I found myself grasping for a metaphor to help them understand this complex process. I finally decided to use metamorphosis as a metaphor to structure the reporting of my data and the answers to my research questions.

### **Metamorphosis: Caterpillar to Butterfly**

Webster (1997) defines metamorphosis as a change in the form or function of a living organism by the natural process of growth or development. Arms and Camp (1982) further elaborate this definition of metamorphosis as the radical change in shape, physiology, and behavior that occurs when a larva becomes a very different-looking adult. The significance of metamorphosis is that it allows an immature animal to have a way of life very different from that of the adult. In metamorphosis the change from the larva to the adult is often abrupt with the intermediate stage being adapted to neither way of life.

I will use the biological process of metamorphosis as a metaphor to help explain the transformation of assessment at MVGS. Metamorphosis, like school reform, is a series of events that leads to the formation of a new organism or, in the case of schools, a shift from a current to a new paradigm. Change that occurs in a school is not a single event but a series of events that leads to the final shift in practice.

The modification of assessment practices can be compared to the life cycle of many animals that undergo metamorphosis. Amphibians and most insects undergo a type of metamorphosis. Complete metamorphosis can be illustrated by looking at the life cycle of a butterfly. The stages, in developmental order, are the fertilized egg, the larva (often called a caterpillar), the pupa (enclosed in a cocoon or chrysalis) and finally the adult butterfly.

The fertilized egg stage of metamorphosis is parallel to the pilot phase of this study. Both processes document the beginning of a significant change. The larval stage can be likened to the implementation phase of the study. This phase is the primary data collection period. The pupal stage, although less defined, can be equated to the end of the first trimester of implementation and the beginning of the second trimester of implementation. The adult stage of the portfolio development process was not observed as a part of this study. These stages of development will act as a metaphorical framework around which the story of evolving assessment practice at MVGS will be told.

Table 5 outlines each metamorphic stage of the butterfly and shows its parallel in the phases of this research project.

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Table 5  
Metamorphic Stages of the Butterfly with Parallels to Research Phase

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Metamorphic Stage	Phase of Research Project
Fertilized egg	Pilot study
Larval stage (caterpillar)	Implementation phase
Pupal stage (cocoon or chrysalis)	First trimester of portfolio implementation
Continued pupal stage	Beginning of second trimester of implementation
Adult butterfly	Not observed as a part of this study

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**Teacher Definitions: Beginnings: The Fertilized Egg**

*Marcus Aurelius Antoninus stated “. . . Observe always that everything is the result of a change, and get used to thinking that there is nothing Nature loves so well.” (Bartlett, 1995).*

Before metamorphosis can occur an egg must be fertilized and deposited in a place where it will develop. The decision to begin to use portfolios in science at MVGS can be equated to the egg stage in a life cycle. The following section answers research question number one - How do the

teachers define portfolios?.

The beginning of this metamorphic story can be traced to the fall of 1995. During this time, the science team at MVGS began to talk about portfolios and formulate a plan for implementing them in their classrooms. Team members agreed to use portfolios at least one trimester of that school year.

One team member explains:

Well, we talked that this year everybody would do this [use portfolios] at least once before the end of the year and if you didn't do it every grading period you would at least do it once before the end of the year. And the goal was that next year everybody would do it . . . every grading period, and you may not do everything in the content piece every grading period but you would do something, you could do some picking and choosing. And when we designed this there were some things which was "A" that the teacher would demand be there and then there was a "B" section where we would say to the kids you need to pick some things you think are significant and put them in there as well.

Various team members began the task of planning the implementation. Documents describing portfolios and outlining implementation of portfolios in the science department were developed. Copies of these documents can be found in Appendix D.

One of the documents created by the science team introduced portfolios to all team members and served as a starting point for discussions of portfolio assessment in science at MVGS. This document, entitled Science Team -- Portfolio 1995-96 Appendix D, includes objectives, a definition of portfolios, justification, a content outline and a description of what a completed portfolio should look like. This document will serve as the beginning point for reporting and discussing the data collected. The definition of a portfolio, as stated in "Science Team -- Portfolio 1995-96" is:

A working documentation of student's skills and talents which reflect self-awareness, self-evaluation, and communication with their peers and their teacher. It is student owned, housed

by the science teacher, student managed with teacher guidelines, and it will include a student header sheet, rationale for why a piece is included in the portfolio. The exhibit of the student's will be carried forward to the next school term (Appendix D).

This stated definition shows many of the characteristics of portfolios outlined in the literature and detailed in chapter two of this dissertation including: 1) a defined goal (e.g. Collins, 1992; Paulson, Paulson & Meyer, 1991),  
 2) a defined use (e.g. Collins, 1992, Paulson, Paulson & Meyer, 1991),  
 3) evidence (Collins, 1991),  
 4) student and teacher made decisions (Valeri-Gold et al., 1991/92),  
 5) reflection (Graham 1993; Vavarus (1990), and  
 6) conferences (Calkins 1983, 1986, 1991; Fu 1992; Graves 1976; Milliken, 1992; Russell, 1983; Smith, 1992; Walker & Elias, 1987).

Table 6 identifies the components addressed by the initial documentation.

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Table 6  
Components of Portfolios Addressed by Initial Documentation

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Components of Portfolios Outlined in the Literature	Components Identified in Pilot Study Year 1995-96
Defined use	Yes
Defined goal	Yes
Evidence	Yes
Portfolio decisions	
Student made	Yes
Teacher made	Yes
Reflection	Yes
Conferences	Alluded to but not directly stated

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The teachers' initial planning and preparation for portfolio implementation showed a clear understanding of all the basic components of portfolios outlined in the literature with the exception of conferences. Conferences were alluded to but not specifically detailed in the excerpt "communication with their peers and their teacher." How portfolios were initially defined and implemented can be further understood by listening to the voices of selected faculty.

During the pilot study, four staff members at MVGS were interviewed and asked how they defined portfolios. One participant noted: . . . It's um a collection of students best work, hopefully, not always their best work. A lot of time is just groups of work and what ever work . . . that is looking for improvement . . . Yeah and yeah we were talking about students and immediately the students use them because if they go on to biology or chemistry or physics, I ask them to separate it into those particular groups. So they can go to that class and say here is what I learned in my intro course, so here is my background. And then of course in the future, they will be looking at careers and college applications and what they don't realize that by taking their portfolios to a college interview they are able to get placed in advanced classes or uh honors classes or even skip classes.

This definition addresses the idea of defined use. This teacher highlights two possible uses for the portfolio. One use stated was the demonstration of concepts learned the previous year. Portfolios would be used by the student as a means of verifying the knowledge obtained in the previous school year science course. Portfolios also would be used as a way of seeking college credit or alternative course placement when the student leaves MVGS. In this instance, the evidence in the portfolio would demonstrate mastery of concepts to college administration officials and possibly help the student obtain advanced academic standing.

Another staff member stated:

Here, because we are working in a setting of developing uh something that can be used by students so that it is a student learning process as well as a teacher learning process and an overall assessment package, we wanted to give the students a

lot more variety of choices so that what they consider their best work goes in their portfolio. Their best work could be something, umm a short reflective narrative on an experience they had, a learning experience, it could be a competence based quiz that they really umm worked extremely hard to understand the concepts and just felt that this was a real turning point in their science education. . . . We wanted it to be a very positive documentation of the learning experience of the student. . . .The new standards of learning . . . I guess . . . I guess, all in all, it is just another way of looking at the students strengths in sometimes. In testing a student we see their weaknesses but it nice to see something very positive. And portfolios are intended to be very positive documents showing the students strengths, maybe showing their growths where they have gone. It also gives the teacher and student opportunities to give input and reflections on on where they've been, where they're going. And it it's also is a document for encouraging the student to improve and continue to strive for their highest standards . . . We would like to be able to have the documentation so well done that the student if they leave here, when they leave here as seniors they would take their science portfolio forward uh and they could do things with that like placement, if they want to lots of times they just take their lab notebook forward, their chemistry lab notebook, uh or their electronic notebook from physics or something else and they might be given credit . . .

This statement highlights many of the important concepts of portfolio assessment outlined in the literature. The idea of an articulated use was stated at the end of the passage. The same idea of obtaining college credit via portfolio documentation also was expressed. The importance of reflection was briefly stated with the comment about a "reflective narrative". Finally the realization that portfolios should be governed by student and teacher made decisions is illustrated by the statement, "we wanted to give the students a lot more variety of choices so that what they consider their best work goes in their portfolio."

Another teacher talks about how a colleague defines what a portfolio is:

I know that with [name omitted] she feels that, basically, her

lab book, she is very rigid with her lab notebook and how it has to be done and all that . . . and so she kind of sees that as being the portfolio for chemistry. That pretty much sums up what she wants them to do.

In this passage an understanding of the components of portfolios is not evident. This same teacher states:

I think it also good that they, that they pick out what they think is their best work and have to share down the road with who ever. More colleges are starting, or at least are being willing to look at portfolios.

The idea of a portfolio being used as a possible means of obtaining advanced standing in college was again articulated.

Finally, in a conversation with another participant, the following points were made: 1) portfolios contain syllabi, course outlines, competencies, rubrics, examples of best work, tests, 2) portfolios are assessment tools, diagnostic tools, placement tools, program improvement tools, and teaching tools for the students themselves for self improvement. This conversation examined many different uses of portfolios and among them was the college placement use discussed earlier.

During the pilot phase of the project the teacher definitions of portfolios in science at MVGS began to emerge. These definitions reflected many of the components of portfolios described in the literature. The closing of one school year and the opening of the next was occurring as the pilot phase ended and the actual research study phase began and this period of time could be considered a beginning metamorphic phase.

Because two of the three teachers interviewed during the pilot study were no longer employed at MVGS during the 1996-97 school year, three new teachers were recruited as participants for the research study. Excerpts from transcripts of interviews in which they outlined their definitions of portfolios are included below:

Ms. Martin offered:

To me, they mean a selection of work that reflects the students work in the class. To me it is not an exhaustive compilation of

their work because that is a notebook or a lab book and all their tests and everything but it should say something about the students' work and it should say something about the students' attitude towards the subject they are studying.

This definition does not explicitly include any of the components of portfolios outlined in the literature. Further conversations with this teacher clarified the beliefs stated in this passage and classroom observations supported the views stated. When portfolios were introduced to the students by this teacher, the ideas expressed to the students paralleled the conversation from which the above quote was excerpted.

Mrs. Hansen stated:

Yeah, for me just being a person on the street that is the first thing I think of is an art portfolio. A person who has an art portfolio. This is my work, this is me, and this is what you see of me and so that is what I think of as a portfolio. This is another way of me seeing you where ever it is that you are going to see it. Um, but now that I have learned some things about portfolios, I also understand that they are used as a progress report. You know, how am I, how have I changed my thinking about something or how have I improved since whatever that time is and also the person because of that will use it as a self-reflection.

Here, Mrs. Hansen, expressed an understanding of reflection being a part of portfolio assessment. The idea of the portfolio being used as a progress report demonstrated the knowledge of the portfolio having a defined use.

Ms. Martin further stated:

Well, it is a compilation of a student's . . . some of the student's better work for a given trimester. And some of the uses . . . it can be used by next year teacher to kind look at the quality of work that the kid does, they can see some of their strengths and some of their weaknesses and perhaps be maybe proactive in certain situations [inaudible] uh, the kids can also use them as something to help them get into a particular college or school. . .

The use stated here is two-fold. One aspect of use refers back to the

previously stated use of possible college placement and the second use also discussed earlier is the idea of the portfolios being used by the students' teacher during the following year.

A written document provided by Mr. Barkley stated the following:  
 Selected Applications: The portfolios are being used to:

1. help assess the attitudes and progress of MVGS science students
2. provide a year-to-year summary of attitudes and progress so that teachers can assess student strengths and weaknesses at the beginning of each school year. This should better facilitate instruction so that students can fully understand teacher expectations and therefore be more successful.
3. help students see the connections between the various science disciplines as they go from year to year.
4. provide a resource of work performed at MVGS to be used in a math/science portfolio if it becomes helpful to provide such for college applications.

A comparison of the teacher definitions of portfolios during the pilot phase and research phase of the study is summarized in Table 7.

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Table 7  
Summarization of Teacher Definitions During Pilot Phase and Research Phase

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Components of Portfolios Outlined in the Literature	Components Identified in the Pilot Study Year 1995-96	Components Identified in the Research Study Year 1996-97
Defined use	Yes	Yes
Defined goal	Yes	No
Evidence	Yes	Yes
Portfolio decisions		
Student made	Yes	Yes
Teacher made	Yes	Yes
Reflection	Yes	Yes
Conferences	Alluded to but not directly stated	No

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The difference noted in teacher definitions from year to year may be attributed to many different factors. One rather obvious factor was the inclusion of different people in the two phases of the study. Another factor possibly contributing to the differences was the amount of teaching experience of the participants. Two of the three participants in the 1996-97 research year possessed three or less years of teaching whereas the two participants they replaced had been teaching much longer.

How the teachers defined portfolios was expanded upon and echoed in their articulations of the value of portfolio use in their classrooms. All teacher participants highlighted the use of portfolios as a tool for college admission. These additional excerpts support this idea. Mr. Barkley said, "I think it also good that they, that they pick out what they think is their best work and have to share down the road with whom ever. More colleges are starting . . . to look at portfolios."

Mr. Barkley also said:

. . . And then of course in the future they will be looking at careers and college applications and what they don't realize that by taking their portfolios to a college interview they are able to get placed in advanced classes or uh honors classes or even skip classes.

Ms. Hansen outlined the value of portfolios for students in the following excerpt: "Yeah, I do in the sense that it kinda keeps the kids sort of organized and they kinda see their progress. I do see some benefit in it." As indicated by data presented in a later section of this chapter, many of the students also identified this value of portfolios.

Ms. Martin highlighted the importance of a portfolio emphasizing the positive accomplishments of a student. She stated that portfolios focus on what a student can do instead of what a student can not do. This quote sums up the value she sees in portfolio assessment:

. . . it is just another way of looking at the students strengths in, sometimes, in testing a student, we see their weaknesses but it nice to see something very positive. And portfolios are intended to be very positive documents showing the students' strengths, maybe showing their growths where they have gone.

It also gives the teacher and student opportunities to give input and reflections on where they've been, where they're going. And it's also a document for encouraging the student to improve and continue to strive for their highest standards.

Dr. Mason, principal of MVGS, discussed how a portfolio can be more than an instrument of assessment. The merits of a portfolio being used as a diagnostic tool, a placement tool, a program improvement tool, a self-improvement tool and a communication tool were accentuated:

. . . I think there is a whole lot more to it, obviously, than just an assessment tool. Uh, it is a diagnostic, it can be used as a diagnostic tool, a placement tool, a program improvement tool. It can be used as a teaching tool for the students themselves for self improvement um, it can be a number of different a number of different things . . . Well, we have already demonstrated that yanking a portfolio out during a parent teacher conference is a very effective way of communicating with parents!

It is interesting to note that all of the teachers discussed portfolios being used as a tool in college admissions. They also noted that other positive portfolio attributes included improvement of student organization, emphasis on student capabilities versus failure, and other ways portfolios are used in addition to individual student assessment. They suggested that portfolios may be also used in a diagnostic capacity, as a placement tool, communication tool or self-improvement tool.

### **Student Definitions: Continued Beginnings: The Fertilized Egg**

Once the butterfly egg is fertilized a great deal of development occurs within it before the caterpillar emerges. The zygote or fertilized egg must divide into millions of cells which differentiate into tissues and organs which form the larva. This process takes time and is parallel to the definitional stage of this research project. Defining portfolios in the words of the participants encompassed two of the seven research questions. The following section addresses research question number four - What are the students' understandings of portfolios and how they are used?.

The student definitions of portfolios showed a great deal of similarity. For example many students stated that they included their “best” work or “exemplary” work or included papers that had “good grades” in their portfolios. Statements like this student’s were common, “You have to have tests, uh, and quizzes and stuff just basically if you have any good tests or good quizzes that kind of stuff to make you and oh yeah you have to have some labs in there.”

Another student offered this definition:, “. . . it is a sampling of work that show a cross section of the work that you did for the entire period of time.” In two separate conversations with this student, the meaning of cross section was probed. He was talking about multiple types of work i.e. lab write ups, quizzes, tests, etc.

When discussing their own definitions of portfolios most students had different definitions for portfolios used in different subjects. For example, when asked about portfolios being used at MVGS one student offered this statement concerning her math portfolio specifically:

. . . it wasn’t only supposed to be our best work but it was suppose[d] to to show like how we improved and our goals for the next trimester.

This comment suggested that the uses of the math portfolio were focused on highlighting improvement and goal setting. When asked if this were true of her science portfolio her response was “probably, but it wasn’t specifically stated.”

Another student referring to a middle school experience with portfolios offered this comment:

Ok, they take all of my quizzes throughout the year and I guess they compare them, like the before and after, or in the beginning of the and the end of the year and look at how much I improved or what I need to work on . . .

This student comment also highlighted the idea of looking at improvement over a period of time.

Still another student, also referring to prior portfolio experiences, offered this definition:

. . . with the portfolio it shows your best work or what ever

or your work over the years or trimester or whatever and it gets to show you your improvements and what you need to work on and what your strengths are and weaknesses and all that kind of stuff and like what you need to do better like say I have a Spanish test and it is on vocabulary and I have another Spanish test and that's on like sentence structure and I keep on getting bad grades in my vocabulary that tells me that I need to do something about the vocabulary but I am good in my sentence structure . . .

This student commented on the portfolios use as a method of demonstrating improvement over time. Using the portfolio also helped her identify strengths and weaknesses. She was able to reflect on her work and articulate areas of achievement and areas that needed improvement.

As a whole group, the students were able to highlight many of the components of portfolios described in the literature. Using the interview transcripts and fieldnote accounts, I was able to identify all of the components of portfolios except conferences.

### **Definitional Comparisons**

In the teacher and student definitions of portfolios similarities and differences are apparent. From a comparison of both definitions to the current literature one can draw a number of conclusions. Refer to Table 8 to identify the key components of portfolio assessment as presented in the literature; note also that the same components were addressed in teacher and student definitions.

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Table 8  
Comparison of Student and Teacher Definitions to Components of a Portfolio Outlined in the Current Portfolio Literature

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Components of Portfolios Definition	Components Identified by:	
	Teacher 95/96	Student
Defined use	Yes	Yes
Defined goal	No	No
Evidence	Yes	Yes

Portfolio decisions		
Student made	Yes	Yes
Teacher made	Yes	Yes
Reflection	Yes	Yes
Conferences	No	No

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Neither the teachers nor the students identified conferences as an important component of portfolio assessment. Members of both groups were able to articulate defined uses of portfolios, although frequently the uses varied from teacher to teacher and student to student. One particular area where similarities existed was in the use of portfolios. Teachers and students both discussed portfolios being used as a tool to gain advanced academic standing in college.

Neither the teachers nor the students expressed an understanding that a defined goal is a component of the portfolio definition. Recall that the goal describes the knowledge and skills that are evidenced by items in the portfolio (e.g. Collins, 1992; Paulson, Paulson, & Meyer, 1991). Evidence was included in the portfolios but the skills and knowledge it was to represent were not specifically outlined or described.

Both students and teachers discussed the evidence included in the portfolios including what the student learned in chemistry during the first trimester. Evidence was not correlated with competencies or standards and therefore did not represent specific concepts learned. Both groups were able to articulate the idea that portfolio decisions were made by both the teacher and the student. Some items were included by all students as directed by the teacher and other items were included at the discretion of the student. The portfolios of the student participants and my fieldnotes demonstrated this.

Reflection was described by both the teachers and the students. Reflection is also discussed in the next section of this chapter which deals with the value of portfolios. Conferences were not discussed by either group.

The students' linked their definitions of portfolios closely to their ideas of the value of portfolios. Value and definition were often intertwined during the interviews and are therefore discussed together.

The teachers and the students suggested that portfolios be used to gain advanced standing in college. All of the student participants stated this at some point during an interview. The following three selected excerpts support this statement:

- 1) “Eventually we will get them back and we will be able to take them to college. . . I will take it with me when I go to college.”
- 2) “. . . last year my teacher said we can use it to show colleges and everything and I’m not sure what that is really like. . . , “ and
- 3) **Student:** I guess just to refer back to any information that might be in there or to show somebody that was looking at your qualifications or something.  
**Weaver:** Like who? Like who might be looking at it?  
**Student:** Maybe a college administrator or something like that . . .

The second value of portfolios discussed by the students was the ability of the portfolio to help the student become more organized. One student offers the following statement:

. . . you know those organization skills are the main thing um when I found out about my portfolio I sat down and cleaned everything out and reorganized. . .

A fieldnote account on [November 13, 1996, 12:25 p.m.] in Ms. Martin’s Advanced Chemical Topics class captured three female students engaged in a conversation about the purpose of constructing a portfolio and what doing a portfolio actually did for them as students in chemistry. This conversation was occurring prior to the actual beginning of class. The students arrived early and prepared to work on their portfolios. As they settled down and waited for class to begin this conversation occurred. The students were working on their portfolios selecting evidences to meet the criteria for portfolio construction. They were engaged in a conversation highlighting the merits of doing a portfolio. The three main ideas extracted from the conversation were 1) to obtain possible college credit, 2) to show what you accomplish during the year, and 3) to keep you organized.

Another portfolio merit expressed by some students was the

possibility of showing future teachers your work. One student echoes her teachers thoughts as well as her own about this merit in the following quote:

**Student:** . . . well last year they said so we would have something to take to show future teachers and I have actually kind of used mine from last year.

**Weaver:** How have you used it?

**Student:** Because some of the stuff that was in there [laughing] we did again this year or did parts of it. So I went back and looked at all the stuff. Because I had it in the house and so I just got to look at it and if we did labs that were similar I could look at the other labs

Another student offered a nice account of how a portfolio she compiled benefited her in her mathematics class. Note the references she made to improvement, strengths, and weaknesses.

**Student:** Well, I think I can look at it, like I looked at my math portfolio and I could see like I had letters from each trimester about what I wanted to improve on and my strengths and weaknesses and I could look back at the work because I tried to put in there not only what was really good but some of the bad stuff so that I could look back and see you know not only like my strengths but how I improve.

**Weaver:** Could you see improvement when you looked at it?

**Student:** Um hum, yeah and I tried to like like in first trimester it was like statistics and I had a lot of problems with like analyzing them. . . and um so I um so that was one of my goals for the next trimester. And um I worked on it and I can see improvement. . . Um, well I guess so that we can look back and see our strengths and weaknesses but also that we can um we get them when we graduate and we can just take them and show colleges and different so we can use them, you know it's usual we have to go back and collect it for all the stuff I have lost from everything and its always just right there and if I need to show samples of my work anywhere I will have it . . .

In summary, the students outlined many merits associated with portfolio assessment. They discussed obtaining college credit or advanced

academic standing, as did their teachers. They highlighted improved organizational skills, as did their teachers. Using the portfolios to demonstrate prior learning was discussed and finally the use of the portfolio to demonstrate strengths, assess weaknesses and highlight improvement was showcased as well.

### **Implementation: Metamorphic Changes: A Caterpillar Emerges**

Once the egg is fertilized tremendous growth and cell differentiation occurs inside this egg. The cells divide and form a larva or immature organism. In the the case of the butterfly, this immature form is called a caterpillar. This stage of butterfly metamorphosis is analogous to the implementation phase of the project. This section details how portfolios were implemented in the classrooms of the teacher participants and addresses research question two - How do the teachers implement portfolios in their classrooms?.

All science teachers at MVGS used portfolios during the fall trimester of the 1996-97 school year except the physics teacher. The portfolios constituted five percent of the students' total trimester grades. I was present when most of the teachers introduced portfolios to their students at the beginning of the trimester and I recorded and analyzed fieldnote accounts of these introductions. Each teacher began the introduction in virtually the same manner by distributing copies of three science team created documents to each of their students. They also gave each student a manila file folder in which to house the completed portfolio.

The distributed documents consisted of:

- 1) Portfolio Requirement GSC 96-97 (Appendix E),
- 2) Teacher Assessment Rubric for Science Portfolio (Appendix F), and
- 3) Table of Contents (Appendix G).

The Table of Contents was completed by each student and included in the submitted portfolio. It contained the name of each item in the folder and the date it was completed.

The grading rubric delineated the items for which the students would receive portions of the 100 point total portfolio score. The points were distributed as outlined in Table 9.

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Table 9

## Portfolio Grading Rubric Points Distribution

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Portfolio Item	Points Awarded
Table of contents	30 points
Legibility	10 points
Items list	20 points
Reason for student's item	20 points
Evaluation of contents	20 points
<b>Total points</b>	<b>100 points</b>

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The rubric also outlined the criteria for awarding points. Each category had a range of points spread over a continuum. For example, under Item 1 - Table of Contents, a student could earn from 0 points, indicating that "Entries could not be found, or did not exist" to 10 points, where "Entries were very neat and legible." Other point categories were included for 5, 8, and 9 points with criteria outlined for awarding the scores. Each of the categories were structured in a similar manner.

The Portfolio Requirements Sheet provided the student with a general description of what would be included in their portfolios. The introductory statement explained to the students that the portfolios would be assessed each trimester. It also stated that the portfolio would be used as evidence of the quality of the students work and progress made while at MVGS and that the document would be passed on to next year's teacher. Finally, this document stated that the portfolio could be used to assist the students in getting into the college of their choice.

Two distinct categories of item inclusion were outlined on this sheet. Category A, entitled Options across curriculum [Teacher directed], included such items as an exemplary laboratory report, project forum research paper/documentation, reflective narrative [self-evaluation], integrative project and an other designation. The other option was to allow each teacher autonomy in their classroom. Option B, Options within individual science courses [Student directed], included such items as tests, competency quizzes, other graded work, graphs, spreadsheets, charts, drawings, diagrams, video, problem set, field trip report, projects - group or individual, peer assessment and an other designation. This other option

was to allow the student to select an item that does not fall in to one of the listed sections.

In addition to the options described above, this document also introduced the students to the summary narrative. The summary narrative required the students to indicate why they selected each student item. It also was used to allow the students the opportunity to state at least one thing they had enjoyed about the chemistry course.

As each of the teachers introduced portfolios to their students, each document was discussed in detail. Students were instructed on how to staple the pages inside the front and back cover of a manila folder. The teachers offered general definitions of portfolios and explained the process as outlined above. This data was included in the earlier definitions section.

An interesting exception to these introductions occurred in one classroom. The students were very vocal and negative in their responses to portfolios in science because their experiences with portfolios in science the year before caused them to form some definite opinions about portfolios. Some of the students were participants in this research study, and when they were interviewed, they made comments about their prior experiences. One student explained her experience with science portfolios during the previous year:

Last year we didn't hear anything about it, she [referring to her science teacher from last year] didn't say anything until the last couple of weeks of school and then she killed us . . . Maybe she, she gave it to us maybe at the end of April. She gave the, she just passed out this rubric and didn't really explain about it. She just kind of passed it out and I just put it into my backpack and I pulled it out one day and I realized that this portfolio is due like next week so I was like Ok, what is this? I don't know what I am doing and then she had made us like, I just had to like search through my notebook and find there was some required assignments and there were some like optional and I just I don't even know where I got them and I just kind of searched through my notebook and found them and we had to write reasons. . . Yeah, it frustrated me because she didn't explain it. I mean it was was the handout she gave us was really vague and she didn't take the time to go over it and

tell us what we needed to do . . .

Other students describe the process is much the same way. One student offered this description:

**Student:** Well the teacher last year had a lot of requirements that seemed like they didn't matter . . . in why it is representative of the work . . .

**Weaver:** So did you have a lot you had to write about each piece? So is that what made it so difficult?

**Student:** Yeah

**Weaver:** um, did you do it all along? Did you do it the whole year long?

**Student:** Well, we were suppose to but she didn't get around to telling us about it until right before it was due pretty much . . .

Overwhelmingly, the attitudes towards last years science portfolios from this class were negative.

In an interview, the instructor of this class made the following comments:

One of the complaints about their portfolios last year for their science classes was that it was a lot of writing associated with everything. They had to write a whole page on why they chose each particular thing and then they had a lot of complaints when I brought up the portfolios about how much time that took and you know how it was, just stupid and what ever but . . . And some of them were very adamant about the fact that they didn't feel that it was a good experience for them. So I tried to kinda tone on the amount of writing . . . when we made the portfolio rubric and assessment, we really tried to at first keep it very simple. In other words, keep the number of items down and to keep the reflection on those items simple . . .

The thought continues later in the interview:

. . . the ones that had to do all of this writing just really got tainted but that sort of writing and so they were just . . . like when I brought out the portfolio envelopes or even mentioned them they just groaned and I could tell which ones were in the

classes that had to do that from last year by their reactions. So, there has been some [reaction], its been either negative or or a lot of people are really neutral about it.

### The Value of Portfolios: Metamorphosis Continues: Inside the Chrysalis

*“ . . . The universe is change; our life is what our thoughts make it.”  
Marcus Aurelius Antoninus (Bartlett, 1995).*

This section addresses research question number six - What do teachers and students believe portfolios represent regarding the learning that occurs in the science classroom? and question seven - What do the data collected via this study demonstrate about portfolios as a valid means of assessing student progress? Both of these question were grouped together under the heading of value. I clustered these two questions together because I believe they both refer to the benefit or lack thereof of portfolio use in the classroom. I also believe that the answers to these questions may help teachers at MVGS decide whether to continue using portfolios as a means of assessment in their classrooms. Answers to these questions were solicited from the students and teachers. Many participants were able to identify benefits associated with portfolio assessment. These benefits included identification of work that needs improvement, identification of overall strengths and weaknesses, evaluation of completed work and the setting of future goals. One student offers this explanation for the benefit or lack there of portfolios:

**Student:** Well, sometimes I can see like what I need to work on but the way it is structured usually I can't figure out what I need to work on because the idea is to pick your best stuff and put it in.

**Weaver:** So all you are seeing is your good work?

**Student:** Right, I don't really know how it helps me.

In this particular incident, the student highlighted a value of a portfolio as a way to show what work needs improvement. This student wasn't sure however that this particular portfolio served that purpose.

Another student made this statement about why he believed he did a portfolio in chemistry:

And so I think teachers have access to them but I am not sure.  
And I don't know if I am going to take them to college, I don't

know what we are suppose to do with them but I am sure I will use them because they are nice and organized and so . . . Both of these students were able to articulate the idea that portfolios are useful to them but they were not quite sure how their chemistry portfolios would benefit them personally.

Another student offered this explanation of the benefits of doing a portfolio.

Well I said that um like keeping the portfolio and looking back over like all the work I had done um I could determine my strengths and weaknesses and I could like evaluate my work and set goals for the next trimester. . . I mean usually like have put my best work in just because you know I don't know but you know I looked over all I had like to look back to the beginning of the year and stuff I hadn't seen forever and I was like oh wow I learned how to do that at the beginning and if I got a bad grade on it then I would do better like on the test or whatever and I could see like you know where I was trying [inaudible] I would just try to improve . . .

This student articulated several benefits of portfolio assessment. She stated that portfolios can be used to identify strengths and weaknesses, evaluate work, set goals for the next trimester and reflect on learned material.

Another student offered this account of portfolio merits.

**Student:** Well I think it showed me a good cross section of my work. I think I chose fairly well in that sense. And it showed me that I didn't like how I'd turned things in. I'd procrastinated too much and so on, I didn't like how I had turned them in and I have been working on it this year and I am doing a lot better.

**Weaver:** So you have actually started doing things a little bit earlier because of the things you saw in your portfolio or . . . ?

**Student:** It was the grades at the end of the trimester in math and I was trying to catch up and do lots of homework at one time and I didn't have a whole lot of graded homework to put in there and my organization was bad last year.

**Weaver:** So portfolios helped you get more organized, is that what you are saying?

**Student:** In a way, they showed me how hard it is to get a good cross section when you are unorganized. And when you are organized with each trimester in a separate notebook or however you want to do it you can get a better cross section of your work and it teaches you that it is easier to stay organized than it is to be unorganized and suddenly have to get organized again.

In this incident the student highlighted a weakness identified by the portfolio. He stated “. . . I didn’t like how I turned things in.” He later stated that the portfolio showed him “that is is easier to be organized than it is to be unorganized and suddenly have to get organized again.”

He continued saying:

**Student:** I like having to do portfolios because it lets me look back at what I did and what I liked and what I didn’t like and all that and I think right now they are pretty much as they show us a good cross section of our work without having us do a whole lot of work. Because the letter to the viewer takes five minutes. It is what ever you want to say. And the other part is just sorting through and getting what you want out so it’s not a lot of work but it shows you a lot for the amount of work that there is involved . . .

**Weaver:** Besides showing you a cross section, do you see that portfolios benefit you in other ways?

**Student:** Yeah, it gives us a good grade that will help boost us but it also gives us something to take on to our next class to show our teachers. It helps them understand how we did in our last class.

In this exchange, the student addressed the idea of portfolios being used for reflection. The use of a letter to the reviewer and the identification of “what I liked” and “what I didn’t “ demonstrates this portfolio benefit. He also stated that the good score earned will “boost” his grade and that he has something to show his next years science teacher.

One teacher responded to the prompt, “What do portfolios tell you about a student?” This teacher stated: “Well, it, one thing that it tells me that I may not already know is um, how they think that that they are doing, as opposed to how I think they are doing.” In order for a student to

be able to articulate an answer to this question they must first be able to reflect on their learning.

This teacher's response offered support to the idea that students are given the opportunity to articulate how they are performing in class. She further elaborated by saying:

Yeah, I think they provide an opportunity for students voice or to have a voice in their in their um, in how their work is presented to their teacher, you know. So like, I have one student who does poorly on lots of stuff but every once in a while he'll say, "Look I did well on this." and I mean he wants to tell me when he does well. He points it out to me over and over again. So that would be an opportunity for him to highlight those things and say that he does, you know, he does do well at parts of the course . . .

Teachers have ample opportunity to highlight what students do incorrectly. Portfolios, for this teacher, gave her the opportunity to celebrate student success.

Another teacher account offered this:

**Weaver:** Does it tell you something about the student that you can't find out in another way?

**Teacher:** Yeah, it tells me what their attitude is about the course. Because I ask them to give me feedback about the course.

This teacher also valued the reflection aspect of the portfolio and used the portfolio to obtain valuable feedback concerning their course. The feedback included, student likes and dislikes, as well as suggestions for changes and improvements.

When asked about the value of a portfolio as an assessment tool, one teacher offered this response:

As an assessment tool? Umm, I guess, in terms of specific assessments, like did you learn this concept, did you learn that concept or did you learn these things in the class, I feel more comfortable with um more traditional methods and I am not talking about just tests but I am more comfortable just giving them an assignment to take home and grading that as as part of it, because a portfolio to me means a selection of work and a grade really to me should be based on how um each concept,

on how well did they learn each and every concept but as an assessment tool for um the entire class as a whole or how well do they understand you know the scientific method or you know what chemistry means or you know how much have they grown during the class. Yeah I see it as an assessment tool and I guess I see it more as an assessment for potential rather than what they have actually achieved.

### **Change Over Time: Metamorphosis Continues: Change Inside the Chrysalis**

As metamorphosis continues extensive changes are going on inside the chrysalis. The caterpillar that enters is changing form to become an adult butterfly after emergence. This phase of the research project continues until the questions and concerns about portfolio assessment are answered or resolved. As the participants, learn more about portfolios and make changes in the portfolio assessment process they approach the final phase or the adult butterfly. The following section attempts to answer research question number three - How do the teachers' definitions of portfolios change during the trimester when they initially implement the procedure? and research question number five - How do the students' definitions of portfolios change over the trimester?

Documentation of change in teacher and student definitions was difficult to see during the limited research time frame. The teachers in this study were aware that changes were needed but were unable to pinpoint what specific modifications should occur. In informal conversations during the second and third trimesters of the 1996-97 school year, the teachers began the process of discussing possible changes in the process for the following year. These questions could be more fully answered in a follow-up study.

Some teacher comments provided insight into the idea of change. In this particular case, one teacher provided these comments. As she began to discuss portfolios with her fellow teachers, with her students, and with me, her definitions of a portfolio began to broaden. This excerpt attests to that:

. . . Um, but now that I have learned some things about portfolios, I also understand that they are used as a progress

report. You know, how am I, how have I changed my thinking about something or how have I improved since whatever that time is and also the person because of that will use it as a self-reflection . . .

This teacher initially described portfolios as a collection of the students “best” work. Upon reflection, however, she amended her definition and stated that portfolios are also used to document progress.

### **Summary of Answers to Research Questions**

#### Research Question #1: How do the teachers define portfolios?

In order to answer this question, I will briefly summarize the teacher’s definitions taken from the data. This question will be answered with respect to the components of a portfolio documented in the portfolio literature. The teacher participants in the pilot study presented a definition that addressed all of the components outlined in the literature. Recall that these components included:

- 1) a defined goal (e.g. Collins, 1992; Paulson, Paulson & Meyer, 1991),
- 2) a defined use (e.g. Collins, 1992, Paulson, Paulson & Meyer, 1991),
- 3) evidence (Collins, 1991),
- 4) student and teacher made decisions (Valeri-Gold et al., 1991/92),
- 5) reflection (Graham 1993; Vavarus (1990), and
- 6) conferences (Calkins 1983, 1986, 1991; Fu 1992; Graves 1976; Milliken, 1992; Russell, 1983; Smith, 1992; Walker & Elias, 1987).

All of the components were addressed by the data explicitly with the exception of portfolio conferences which were alluded to. These findings can be contrasted to the definitions of portfolios offered by the teachers in the research phase of the study.

The teachers in the research phase of the study offered definitions that addressed four of the six components of portfolios outlined in the literature, but their definitions failed to address the goal of the portfolio and portfolio conferences. Transcript and field note data provided evidence to support these findings. Teachers in the pilot phase of the

study were able to identify more portfolio components than teachers in the research phase of the study.

Research question #2: How do the teachers implement portfolios in their classrooms?

The time line in Table 10 briefly summarizes the major events of the portfolio implementation process at MVGS.

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Table 10  
Implementation Time Line

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When	What Occurred
Fall 1995-96	Initial Planning and Preparation for Portfolio Implementation
Fall 1996-97	Science team members used portfolios one trimester during school year Science team implementation of portfolio assessment
September 1996	Three teacher participants introduced portfolios to their respective classes
October and November 1996	Students compiled individual portfolios
December 1996	Teachers complete first evaluation of portfolios

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The three teacher participants introduced portfolios to their students in virtually the same manner. Each distributed and discussed the three Science Team created documents found in Appendix E. Each of the teacher participants began their classroom introductions to portfolios by asking their students about prior portfolio experiences. Students in the two Governor's School Chemistry Classes relayed their experiences from middle school and other subjects. The students in the Advance Chemistry topics course offered their prior experiences with math and science portfolio from the previous year at MVGS.

Each of the teachers allowed the students to work on their portfolios

at least two separate days in addition to the day portfolios were introduced. I was present and observed the students and teachers during each of the portfolio work days. Students discussed the selection of items to include in their portfolios, among themselves and with their teacher, and they wrote their reflective narratives. Their conversations included the purposes for compiling the portfolios.

Each teacher was available to assist the students during the portfolio work sessions. Students often asked questions concerning items they were choosing to include in the portfolio. For example, on one occasion a student asked if he could include a homework assignment that he had completed but was not collected or graded. The teacher said yes and the student placed the item in his portfolio.

At the close of the trimester, an individual portfolio was submitted by each student. The teachers reviewed the portfolio and assessed them accordingly. The portfolios were then returned to the students.

Research Question #3: How do the teachers' definitions of portfolios change during the trimester when they initially implement the procedure?

As stated previously, the answer to this research question was difficult to ascertain from the data collected in this study. The limited time frame of the data collection phase of the project contributed to this. This question could be more fully answered in a follow up study. Some minor modifications in the portfolio definitions were evident. The broadening of one teacher's definition provides some evidence to support this statement. The teachers were able to articulate the need for change but were unable to pinpoint what needed to be changed.

Research Question #4: What are the students' understandings of portfolios and how they are used?

Student participants like the teacher participants identified four of the six components of a portfolio outlined in the literature. The students failed to identify the same components as their teachers. Recall that the components were portfolio goal and portfolio conferences.

Research Question #5: How do the students' definitions of portfolios change over the trimester?

The student definitions of portfolios remained virtually the same. The definitions articulated by the students in the initial interviews and the follow up interviews were remarkably similar. The data were further triangulated using the PMI charts created at the end of the first trimester by each student.

Research Question #6: What do teachers and students believe portfolios represent regarding the learning that occurs in the science classroom?

Answering this question requires looking at the value the teachers and the students placed on portfolios in the science classroom. Among the identified benefits of portfolio usage were: 1) students can identify strengths and weaknesses, 2) students can identify work that needs improvement, 3) students can reflect on and evaluate completed work, 4) students can set future learning goals, and 5) students can improve organizational skills. These articulated portfolio benefits are directly related to student learning.

Research Question #7: What do the data collected via this study demonstrate about portfolios as a valid means of assessing student progress?

The portfolio process provided the teachers with an opportunity to assess their students in a way that was different from traditional assessments such as quizzes and tests. The portfolios allowed the teachers to focus on what the students were able to accomplish instead of concentrating on what the students did not know or understand. The portfolio also allowed the students to articulate their own beliefs about their personal performance in chemistry. Compiling the portfolio and writing the reflective narrative also gave the teacher additional feedback not usually associated with traditional measures of assessment, i.e., student likes and dislikes concerning the course. Portfolios are a valid means of assessing student progress.

The data presented in this chapter provided answers to six of the research questions while an answer to question number three was not readily ascertained, probably due to the limited time-line for this study.

During the pilot phase of the study, the teachers and students defined portfolios. Referring back to the metaphor, this is the time that the fertilized egg slowly matured into a caterpillar. Both processes refer to a period of growth and development.

During the larval stage the caterpillar consumes a wide store of food and stores energy to encase in the chrysalis and eventually emerge as an adult butterfly. As portfolios were becoming a part of the assessment package at MVGS, they underwent change. The planning consumed time and energy, just as the caterpillar.

As the pilot phase of the study ended and the caterpillar shrouded itself in the cocoon, one school year ended and a new year was about to begin. At the beginning of the next school year, two new science faculty joined the team. The definition of science portfolios changed as the faculty changed. Change was evident throughout the entire research study.