

DIARIES AND JOURNALS:

an aid to learning?

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FLOWERS ARE RED
by Harry Chapin

One morning
When a little boy had been in school a while,
The teacher said:
“Today we are going to draw a picture.”
“Good,” thought the little boy.
He liked to draw pictures.
He could draw all kinds.
Lions and tigers,
Chickens and cows, trains and boats,
And he took out a box of crayons and began to draw.
But the teacher said: “Wait!
It is not time to begin!”

And she waited until everyone looked ready.
“Now”, said the teacher,
“We are going to draw flowers.”
“Good,” thought the little boy.
He liked to draw flowers,
And he began to draw beautiful ones
With his pink and orange and blue crayons.

But the teacher said, “Wait!
And I will show you how.”
And, it was red, with a green stem.
“There,” said the teacher,
“Now you may begin.”
And the little boy looked at the teacher’s flower,
Then he looked at his own.
He liked his flower better,
But he did not say this.
He just turned his paper over
And made a flower just like his teacher’s.
It was red with a green stem.

On an other day, when the little boy had opened
The door from the other side all by himself,
The teacher said:
“Today we are going to make something with clay,”
“Good!” thought the little boy.
He liked clay.
He could make all kind of things with clay.
Snakes and snowmen,
Elephants and mice, cars and trucks.
And he began to pull and pinch
His ball of clay.
But the teacher said:
“Wait! It is not time to begin!”
And she waited until everyone was ready,
“Now,” said the teacher,
“We are going to make a dish.”
He liked to make dishes.
And he began to make some.
They were all shapes and sizes.

But the teacher said, "Wait!
I will show you how."
And she showed everyone how to mould one deep dish.
"Now you may begin."
The little boy looked at the teacher's dish,
Then he looked at his own.
He liked his dishes better than the teacher's,
But he did not say this.
He just rolled his clay into a big ball again,
And made a dish like the teacher's.
It was a deep dish.

And pretty soon
The little boy learned to wait,
And to watch
And to make things just like the teacher
And pretty soon,
He didn't make things on his own any more.

Then it happened
That the little boy and his family
Moved to another house,
And the little boy
Had to go to another school.

And the first day
He was there,
The teacher said:
"Today we are going to draw a picture."
"Good," thought the little boy,
And he waited for the teacher
To tell him what to do,
But the teacher didn't say anything,
She just walked around the room,
When she came to the little boy
She said, "Don't you want to draw a picture?"
"Yes," said the little boy.
"What are we going to draw?"
"I won't know what it is until you draw it," said the teacher.
"But how shall I draw it?" asked the little boy.
"Why, any way you like," said the teacher.
"And any colour?" asked the little boy.
"Any colour," said the teacher,
"If everyone draws the same picture?"
And uses the same colours,
How would I know who made the picture?"
"Why, I don't know," said the little boy.

And then he began to draw a red flower
. with a green stem.

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Synopsis

This research examines the use of diaries and learning journals with a fourth year biology class in a Scottish secondary school. It reviews some of the literature on learning journals and reflective learning in adults.

The results were analysed both quantitatively and qualitatively and demonstrated that diary-keeping was a vehicle that students found engaging. There was some evidence of reflection in some of the diary entries but it is not clear if reflective learning is cognitively possible with students at this stage of development.

Problems of using a non-directive format are discussed although this format is not recommended at this stage.

CHAPTER 1

Introduction

1.1 Aim and objectives

The aim of this short piece of research was to explore the use of diaries and learning journals in the context of a Scottish secondary school as a possible vehicle to enhance learning. There were two objectives:

1. to find out how a class of biology students would use an unstructured diary format
2. to analyse the contents of the resultant diaries to ascertain whether diary-keeping might be an aid to learning.

1.2 Background

While the purposes of “education” are manifold, two specific aspects were being addressed in this research; namely that education can provide students with qualifications that will allow them to maximise their chances of doing what they wish in adult life, and can help

students develop holistically integrating the knowledge they gain from their formal education with the knowledge they gain from the myriad of other sources they have access to.

Teachers tend to be very successful at getting at least some students to pass examinations. However, it has been graphically demonstrated by McCormick¹ that what a student knows may not be the same as what the teacher believes is being assessed. He describes how the BBC filmed graduates from Massachusetts Institute of Technology as they were being asked what they thought a piece of wood was made from. Not only were most unable to answer correctly, the majority had difficulty accepting the correct answer when they were given it.

This can be juxtapositioned with the realisation that some extremely able students leave formal education with knowledge far greater than they have been able or allowed to demonstrate. The original thoughts which lead to this project arose from an incident with a fourth year student who demonstrated challenging behaviour in class and was destined to leave the school with little formal qualifications. This student, however, had an extensive and detailed knowledge about fungi which had never been recognised because fungi was not a topic for assessment procedures. It was only through a casual comment on the part of the teacher that the student grasped the opportunity to share her interest with the class. This experience happened over fifteen years ago but has proved to be enduring for the teacher.

Obviously, a good teacher will make every attempt to interest his or her classes and will try to ensure that the work in hand is linked to the student's previous knowledge and interests but it is a pipe dream to imagine that some of the students with their own unique interests will not get lost in the system as had happened in this student's case.

Class teaching can only address a tiny fraction of work within the totality of a single subject. What is taught inevitably is largely dictated by the assessment procedures in place, especially when the results of these assessments are needed for the next stage in life, whether this be tertiary education or the life of work.

That students' talents and interests can be lost in the system is disturbing. So is the situation where it appears that there has been successful teaching of a subject using the criteria of examination results yet the students may remain ignorant of some basic concepts. These concepts in all likelihood had been assessed and the assessments had been passed. Thus, and not surprisingly, there had arisen the assumption that these concepts have been assimilated. It is often only when the student is studying at Higher or Advanced Higher level in a subject that misconceptions are identified that have been carried over from Standard Grade or the Intermediate levels. The learning has been sufficient for assessment purposes but the assimilation has been idiosyncratic or missing.

To summarise, there seems to be a potential problem here of finding out what students actually do know – and this problem applies both to those students that appear to be struggling in a subject and those who may be demonstrating a high level of competence as judged by the current assessment procedures. What seems to be needed is a method of accessing the integration of new material and witnessing the development of schema. This would involve developing a method of accessing material being assimilated both from formal lessons and from other sources. This research project was an attempt to ascertain whether diary-keeping or journalling could form the basis of this access.

1.3 Diaries and journals

Bolton² briefly discusses the differences between a diary and a journal. “The diary is one of the oldest forms of literature in the west.” “These diaries contain stories of happenings, hopes and fears of what might happen, memories, thoughts and ideas, and all the attendant feelings.” However, the journal “is a record of happenings, thoughts and feelings about a particular aspect of life.” “A journal can record anything relative to the issue to which it pertains.”

There is a quite extensive body of research on the use of learning journals because they have been recognised and become popular as a means of demonstrating reflective learning - reflective learning having been postulated as the means by which adults assimilate new information.^{2,3,4} In particular, Moon⁵ has discussed different forms of journal writing as a means of learning through reflection.

Learning journals that are more structured have been used extensively at university level in many courses.^{6,7,8,9,10} Here, usually there is clear guidance on what is expected and the learning journals are often used as one form of assessment.

The Scottish Qualifications Authority require the keeping of a laboratory notebook, a form of journalling, which is used for assessment purposes in the awarding of Advanced Higher in the sciences. However, in general there seems to be less use of this format with school students. Wardrop¹¹ has used learning journals with mathematics students but other references were not found in the short time available for a literature search.

Nevertheless, it appears that for the teacher of school-aged students, there are several potential advantages to setting a journal exercise which can be quite divorced from assessment purposes. These include:

1. it would be a unique record of what in each lesson stands out for the student.
2. it would provide a rapid method of feedback on what teaching methods are effective for this particular student.
3. the development of incorrect ideas could be caught at an early stage when they are more open to modification.
4. specific points of interest would be recognised allowing the possibility of their incorporation into later lessons.
5. future lessons would be made more relevant to the students present.
6. areas that are causing specific difficulties for several students would be recognised allowing them to be revisited earlier than after an assessment.

With all this in mind, a biology class was asked to keep a diary or journal for part of the first term of their fourth year.

CHAPTER 2

Methods

2.1 Introduction to sample population

A class of fourteen fourth year Standard Grade biology students were introduced to the idea of journalling by being shown “The Country Diary of An Edwardian Lady” by Edith Holden¹². It was explained that keeping a journal was a traditional biological exercise, that a journal was a type of diary and that the journal would be the property of the individual student. It was explained that diaries (the students referred to these as diaries throughout) would be read at least once a week and anything that required a response would generate a response that did not involve tampering with the diaries. It was suggested that the diaries could be a means of communicating with the teacher.

The students were told that this was an exploratory research project to find out if diary-keeping or journalling might be a useful tool for Standard Grade biology students.

2.2 Recording

The students were asked to keep a diary for an indeterminate time span initially. The diary-keeping was stopped after eight weeks because there was a natural break in the rhythm of their learning at that stage – they had entered a diet of examinations. The chosen period had covered learning about two out of the twenty-seven subtopics required for Standard Grade biology, namely “Co-ordination” and “Changing Levels of Performance” (Appendix 1), a week of work experience outside the school and some time for revision for school examinations.

In this school, fourth year students attend the biology department three times a week for a lesson lasting a few minutes short of one hour when in school. The diary period covered 56 timetabled lessons.

The biology lessons were stopped five minutes early to allow time for the entries into hard-backed, lined books to be made. The teaching time apparently lost was believed to be minimal because the last five minutes in a practical lesson is often required for “tidying up” equipment as opposed to formal class teaching. The routine became quickly established to the extent that students would remind their teacher if they felt the lesson was encroaching on their “diary time”.

The teacher also kept a diary for the first two weeks of the project. It had been the intention to do so for the whole eight weeks but the teacher's diary proved to be a mere duplicate of the teacher's record of work.

Once each week, at the end of the middle lesson of the week, the students left their diaries behind to allow the contents to be read. On those occasions when a response was required, a comment was written on separate paper and placed in the diary. This emphasised that the diary was the student's property and not available to the teacher for writing in.

2.3 Analysis

Using a diary format gave rise to information that was naturally qualitative. However, the material also allowed some quantitative analysis.

A simple coding system was devised which allowed the diary entries to be classified into five broad categories:

- 1 - entries about the knowledge content of the lesson
- 2 - entries about the process of the lesson

- 3 - entries referring to reflections on biology
- 4 - entries referring to reflections on an unrelated area
- 5 - entries about topics not related to biology.

The quantitative analysis was expected to provide information on the way the diaries were used by the biology students (objective 1). As well as serving this purpose also, the qualitative analysis was expected to provide information concerning the usefulness of the diaries as an aid to learning (objective 2).

CHAPTER 3

Results

3.1 General comments

The entries in the diaries ranged from brief, although informative comments (e.g. “revision”) to extended responses of around seventy five words (“I done quite good today got all the work finished. Revising for the test because I want to do well. I’ve had a chemistry test and failed it. Chems too hard biology is more fun and interesting there is more to learn stuff that actually matters in life and that is useful. Chemistry is just a waste of space. I quite liked this topic I learned a lot more than I thought I would”).

Only 13 journals were available for the final analysis. There were 147 dated entries in total.

3.1 Quantitative aspects

The coding system outlined in the methods section was applied to the diary entries. Table 1 illustrates how specific examples were coded.

Table 1 – Examples of coded responses

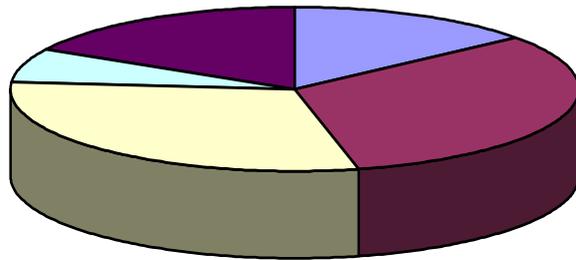
CATE- GORY	DESCRIPTION OF ENTRY	STUDENT	EXAMPLES
1	knowledge content of the	1 3	- <i>Did pulse rate etc.</i> - <i>Today we learned about</i>

	lesson	13	<i>different parts of the brain and their functions. - I learned about the ear and how it works.</i>
2	process of the lesson	2 6 9	<i>- I also did some questions on the eye. - I think we should be allowed to talk but just whisper as long as we do our work. - We did revision for test and a checktest.</i>
3	reflections on biology	4 6 12	<i>- I thought I had done quite well in (the general test). - I enjoyed today's lesson. - Boring.</i>
4	reflections on an unrelated area	1 5 7	<i>- My belly was shouting "feed me" which distracted my hand and made be open a packet of crisps . . . - I was really tired. Life can be boring.</i>
5	topics not related to biology	3 4 10	<i>- I also learned how to make a paper swan. - We laughed today . . . - . . . there are 52! American nuclear bases in Britain and 32 of them are in Scotland!!!</i>

Many of the entries fitted into more than one of the response categories. The 147 entries gave rise to 454 different statements. Figure 1 shows the distribution of the different entries into categories and table 2 tabulates these results.

Figure 1

TYPE OF RESPONSE



- knowledge content of lesson
- process of lesson
- reflections on biology
- reflections on an unrelated area
- topics not related to biology

Table 2 – Percentage type of responses

RESPONSE CATEGORY	PERCENTAGE
knowledge content of lesson	14.1
process of lesson	32.3
reflections on biology	30.0
reflections on an unrelated area	6.6
topics not related to biology	17.0

Those responses concerning the process of the lesson and those concerning reflections on biology are each just short of one third of the total number of responses and both are almost double any of the other type of categorised response.

The majority of the responses contained multiple ideas. The richness of the entries is illustrated by only around one quarter of them falling into a single response category – either an entry about the knowledge content or process of the lesson, one referring to reflections on biology or an unrelated area, or an entry referring to a non biological topic. Moreover, nearly half of the diary entries fitted into two of the response categories with over a fifth of the diary entries fitting into three response categories. Figure 2 shows the distribution of the different entries into categories and table 3 tabulates these results.

Figure 2

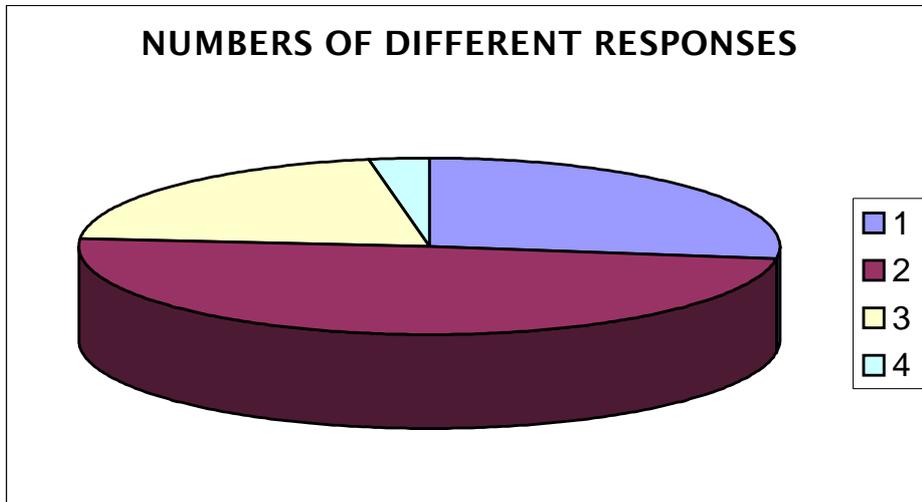


Table 2 - Number of different responses per entry

NUMBER OF TYPES OF RESPONSE	NUMBER OF ENTRIES	PERCENTAGE OF ENTRIES
1	39	27.1
2	71	49.3
3	30	20.8
4	4	2.8
TOTAL	147	100.0

3.3 Qualitative aspects

In addition to the wider examination of the diaries, specific diary entries were noted that were indicative of the diaries having value as a communication tool between student and teacher across a wide range of areas.

Only one occasion arose when there was biologically incorrect factual information contained in a diary. In response, a note was placed into the diary concerned asking the student to see the teacher. Correction of the mistake was then tackled verbally.

One student mused in her diary about not having access to a particular book at home, providing specific details on how it was preventing her studying as effectively as she might – the department policy at that time was to not loan out this particular book. The situation was reconsidered and the book was loaned to her. She used her diary to reflect on how her studying was able to progress more efficiently as a result.

A third student used the diary to make it quite clear that the teacher had been inconsistent in the marking of some homework and two further students went into some considerable detail about how they did not like being told to stop chatting.

Two students left school some time after the diary exercise was finished. In both cases, their diaries were indicating that there was a problem in their lives. However, in one case it was not obvious what was going on and, in the other case, the information was coded in such a way that it would have needed quite extensive work to establish that something was wrong. Both students had been expected to be successful in their Standard Grade Biology course.

CHAPTER 4

Discussion

4.1 General

The aim of this research was to explore the use of diaries and learning journals in the context of a Scottish secondary school which it has successfully achieved. It met the first objective – to find out how a class of biology students would use an unstructured diary format. The second objective – to analyse the contents of the resultant diaries to ascertain whether diary-keeping might be an aid to learning - has been partially achieved.

4.2 Entry coding

Similar to many pieces of social research, the findings are complex and dependent to a large extent on the interpretation placed on them. To analyse the diaries, a simple coding system had been devised. Such systems are notorious for their subjectiveness and this was compounded by the coding being implemented by the teacher-researcher herself. This has to be a major criticism of the study. There was no attempt to increase the objectivity by using a third party to code the diary responses or even to check the coding by the teacher-researcher. However, the project was not attempting to

demonstrate the effectiveness of how the diaries were used – rather it was attempting to ascertain how an unstructured diary format would be received by the students and, to this end, the coding system gave a broad indication of its worth.

The coding system was deliberately kept simple as a mechanism to maximise the admittedly limited objectivity of the method used. A more detailed coding system could have helped to minimise uncertainties around the boundaries of each category. Such a detailed system would be essential if this study was to be repeated on a larger scale using more teachers.

The keeping of a diary after each lesson proved to be a task that students found engaging once they had realised that there was no “right way” of doing it. What was produced by all the students was a clear record of what had taken place during the lesson. This record confirmed that what the teacher intended to teach was received by the students – though this is not necessarily, of course, the same as confirming that this is what the students assimilated!

4.3 Evidence of reflective learning

It had been attempted to provide as little direction as to what was expected to be written about as possible although there were indications that it was to focus on biology. The resultant diaries charted the lessons that were experienced. However, the diaries demonstrated little reflection on the work that was carried out in class. Also, the students rarely recorded any new information that was gained in the context of previously learned information. This would suggest that there was little evidence of reflective learning.

Conversely, there were many comments concerning the way the student felt about new information, the way the lesson was constructed and what the information meant to them. This is clearly evidence of some form of reflection if of an embryonic nature.

While there is an increasing body of knowledge concerning reflective learning in adults, there seems to be little as yet which concentrates on reflective learning in a younger person. There has arisen a tradition that young people learn in a different way from adults. It is widely accepted that adults go through a cyclical process⁴. However, there seems to be a reluctance to extend this into the way young people learn. This may require challenging. If this is true, then the lack of reflection found in this research may be due to it being an emergent capacity that is still being developed in the cohort used.

4.4 Directiveness

It is apparent that there is a major issue for the teacher wishing to use diaries as to how directive he or she is when introducing the task. If the diary's primary purpose is to be a means of communication between the student and the teacher, then minimal direction is essential – clearly, this was the route this research took. However, the opportunity for reflection and a deeper working of the information may be lost – and this was the case for most students most of the time in this piece of research.

It begs the question, would it have been helpful if guidelines had been offered, possibly in the form of questions, to encourage the students to reflect on the work in hand. Bolton² suggests the following questions when writing about “episodes of experience”.

- What was **done** on any particular occasion?
- What was **thought** about it?
- What was **felt** about?

A further three questions might be added:

- How does this **connect** with work you have done before in **biology**?
- How does this **connect** with work you have done **in other subjects**?
- How does this **connect** with **everyday life**?

These additional questions follow a well worn path on how a teacher should construct his or her lessons. A *pro forma* could be constructed not dissimilar to that used for a teacher's CPD learning log. The students would be directed to work with the learning they have experienced and to actively link it into what they already know, have worked with and are familiar with.

While this seems a useful way to proceed, conversely, being this directive may force the student away from spontaneous comments. Many of the comments were not focused on the lesson. Nevertheless, it seems that they were important comments carrying information that is likely to be lost by being too directive. Several students revealed information that was not directly connected to the biological information they were receiving during their lessons. However, what they were revealing were matters that were having a material effect on their ability to function during the lesson and, in fact, within the school environment.

Some students felt sufficiently confident to criticise the biology lessons and the way their teacher was working. To introduce the suggested questions could draw the student away from what might be uppermost in their minds at the time of starting to write thus restricting and hampering communication opportunities.

4.5 Non factual information

There is a real dilemma as to what the teacher does with additional, non biological information that may be provided. The entries written by some students were very rich in feeling comments and not all were subject-related. Some of these entries appeared to be emotion-laden and tended to elicit a complementary emotional response in the reader.

It also became apparent that, along with all other teachers, as an individual the teacher-researcher had limited agency within a school – and this limitation carries over even into the teaching process. Even in departments which are managed in a climate of collective decision-making, decisions will arise that an individual teacher will profoundly disagree with but will still require to implement. It can be difficult when a student is complaining and the teacher agrees with him or her but is bound by a department decision.

Further, there seems to be a tacit understanding between students and teachers that some aspects of school life are not subject to alteration. Schools by their nature are institutions that cannot generally cater for the individual irrespective of how much this might be the ideal

situation. Ways are sought to accommodate – more or less – the majority of students and these are largely successful.

Using an unstructured format gave the students permission to comment on any aspect of the school – or their life. While it is relatively easy to dismiss the verbal “moans and groans” of a vaguely disgruntled pupil, it is far less easy to do so when it is in the form of a highly personal, private communication to the teacher. Worse, the teacher can find him- or herself in agreement with the student over some aspects of the school – and, even, of life in general - but is rarely in a position to change what is being riled against.

This project provided a fascinating and privileged glimpse into the likes and dislikes, the social lives, the hopes and disappointments of individual students. However, it did demonstrate how insecure and uncertain, how frightened and worried some students are and it is distressing to know that a teacher is not generally in a position to solve many of the problems that a student experiences - let alone to make the world at large a more secure place for the individual.

Teachers set examinations and conduct assessments as part of their remit. There are the one or two students who never seem to achieve as well as expected. The diary entries of some very successful students demonstrated an over-riding preoccupation with tests and examinations. Small checktests that were successfully passed carried

a weight far greater for the student than for the teacher – who would use it for reinforcement purposes rather than for assessment. How a student felt he or she had performed in an end of unit test was commented on and seemed to be bound up with how the student perceived his or her worth.

4.6 Emotional content

Teachers are not generally trained to deal with the unprocessed and raw emotions of distressed adolescents. This is more the sphere of the psychotherapist. Unfortunately, the two roles – psychotherapist and teacher - contradict when the professional is faced with a student who has personal reasons for not being able to engage fully in learning a concept.

In the teacher-role, it is the exception for the personal reasons that are affecting a student to be revealed and it is only done so when these personal reasons are usually overwhelming or when the teacher specifically seeks out the information. However, diary writing was an invitation to reveal so very much more about who the student is and forces the teacher into a position much more analagous to that of a psychotherapist with regards the depth of emotional content of the accounts. In these was exposed the rawness of emotions: the anxiety

of how well the student was doing, the anger at the way he or she perceived he or she was being unfairly treated, the sadness at not understanding something.

A psychotherapist is trained to deal with these unprocessed emotions whereas a teacher is not. Thus, there arises a health warning. If diaries are to be used as a vehicle for learning, then they MUST be structured to discourage the disclosure of personal information OR the teacher must be trained in what to do with such information so that it is not open to unintentional abuse by or of the teacher or so that the teacher is not left feeling unprotected and unsupported in what he or she learns.

4.7 Legal implications

In the USA, there has been several court cases concerning the invasion of privacy arising unintentionally when teachers have asked for “feeling” information and when students have been asked to write essays on the lives they have outside school¹³. In the UK, the Children Act¹⁴ and the resultant amendments to the relevant Scottish acts have the requirement that we disclose certain types of information – confidentiality in the teaching profession is not absolute. The keeping

of diaries opens the teacher up to a minefield of potential problems as demonstrated by the material produced during this research.

CHAPTER 5

Conclusions

This research was one of exploration and, as such, it has been successful. The students that were approached diligently kept a record of what they were doing in their biology classes for a period of eight weeks. The entries tended more towards a diary format than that of a learning journal if the criteria of reflection is used to differentiate these two forms of writing. However there was some evidence of reflection in some entries.

The instructions given to the students were essentially non-directive. The diary entries were information-rich in many cases with a substantial minority of comments not directly relating to biology.

The diaries developed into a means for communication between some students and their teacher. As such, it became possible for the teacher to work at a more personal level with some students.

The project did not set out to definitively establish whether diary-keeping might be an aid to learning. However, there are sufficient

indications present to suggest further research in this area would be worthwhile.

CHAPTER 6

Recommendations

Based on this research, the following recommendations are made:

1. if diary-keeping is to be used as a means of enhancing learning or for assessment purposes, the expected contents need to be defined and limitations need to be explicitly stated.
2. additional research is required into whether diary-keeping or journalling is an actual aid to learning for Scottish secondary school students at least with older students.
3. additional research is required to establish whether reflective learning is available cognitively to adolescent students and if there is a stage in development beyond which reflective techniques could be usefully employed.

References

¹ McCormick, R. (1999). Practical knowledge: a view from the snooker table. In R. McCormick and C. Paechter (eds.) *Learning and Knowledge* (pp. 112-135). London: Paul Chapman Publishings Ltd.

² Bolton, G. (2001). *Reflective practice*. London: Paul Chapman Publishings Ltd.

³ Schon, D. (1983). *The reflective practitioner*. London: Basic Books.

⁴ Kolb, D. (1984). *Experiential learning*. London: Prentice Hall.

⁵ Moon, J. (1999). Learning through reflection. In F. Banks and A.S. Mayes (eds.) (2001) *Early professional development for teachers* (pp364 – 378). London: David Fulton Publishers Ltd.

⁶ Schmuck, P. (1992). Educating the new generation of superintendents. *Educational Leadership*, 49(5), 66-71.

⁷ Morrison, K. (1996). Developing reflective practice in higher degree students through a learning journal. *Studies in Higher Education*, 21(2), 317-32.

⁸ Callister, L.. and Hobbins-Garbett, D. (2000) “Enter to learn, go forth to serve”; service learning in nursing education. *Journal of Professional Nursing*, 16(3), 177-83.

⁹ Burnett, P. and Meacham, D. (2002). Learning journals as a counselling strategy. *Journal of Counselling and Development*, 90(4), 410-5.

¹⁰ Langer, A. (2002). Reflecting on practice: using learning journals in higher and continuing education. *Teaching in Higher Education*, 7(3), 337-51.

¹¹ Wardrop, H. (1993). Mathematics language problems. *Australian Mathematics Teacher*, 9(1), 10-13.

¹² Holden, E. (1977). *The country diary of an Edwardian lady*. London: Michael Joseph Ltd.

¹³ Jenkinson, E. (1990). *Student privacy in the classroom*. Bloomington IN: PhiDeltaKappa Foundation.

¹⁴ Children Act 1989 (c.41). London: HMSO.

APPENDIX 1

Topic: **Body in Action**

Subtopic: **Co-ordination**

Level: **General**

State that judgement of distance is more accurate using two eyes rather than one.

Identify the cornea, iris, lens, retina, optic nerve and state their functions.

State that judgement of direction of sound is more accurate using two ears rather than one.

Identify the ear drum, middle ear bones, cochlea, auditory nerve and semi-circular canals and state their functions.

State that the nervous system is composed of the brain, spinal cord and nerves.

State that nerves carry information from the senses to the central nervous system and from the central nervous system to the muscles.

Level: **Credit**

Explain the relationship between judgement of distance and binocular vision.

Explain how the arrangement of semi-circular canals is related to their function.

Describe how a reflex action works, using a simple model of a reflex arc.

State that the central nervous system sorts out information from the senses, and sends messages to those muscles which make the appropriate response.

Identify the cerebrum, cerebellum and the medulla and state their functions in simple terms.

Topic: **Body in Action**

Subtopic: **Changing Levels of Performance**

Level: **General**

State that continuous or rapidly repeated contraction of muscle results in fatigue.

State that fatigue results from a lack of oxygen and build up of lactic acid.

Explain why pulse rate and breathing rate increase with exercise.

State that with exercise pulse rate, breathing rate, lactic acid levels rise less in an athlete than an untrained person.

State that recovery time is taken to return to normal levels of pulse rate, breathing rate and lactic acid levels.

Describe how recovery time can be used as an indication of physical fitness.

Level: **Credit**

Explain muscle fatigue in terms of anaerobic respiration.

State that training improves the efficiency of the lungs and circulation.

Explain the relationship that exists between the effects of training and recovery time.