Impact of a learning portfolio on reflective, clinical and communication skills in undergraduate dental students- A pilot study

Prashanti Eachempati[1], Avinash Supe[2], Raakhi Tripathi[2], Kiran Kumar KS[1], Htoo Htoo Kyaw Soe[1], Abdul Rashid Hj Ismail[1], Anoop Mayya[1], Anand Francis Farias [1]

Corresponding author: Prof Prashanti Eachempati prashanti.eachempati@manipal.edu.my
Institution: 1. Melaka Manipal Medical College, Manipal Academy of Higher Education (A Deemed University), 2. GSMC FAIMER Regional Institute, Seth G S Medical College and KEM Hospital
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Abstract

Student portfolios are a collection of evidence, prepared by the student and evaluated by the faculty member to demonstrate mastery, comprehension, application, and synthesis of a given set of concepts. The purpose of this study was to investigate the effect of portfolio on student's self-reflection, clinical competency and communication skills in daily clinical practice and to know students perception on faculty feedback. A randomized controlled, triangulation study was conducted in Melaka-Manipal Medical College with thirty consenting Year IV BDS students as participants. There was statistically significant improvement for all the outcomes tested in the portfolio group compared to traditional logbook group.

Keywords: Student Portfolio; Reflective learning; Critical thinking.

Introduction

In 1990, Miller wrote that no tools were available for assessment of what a learner does when functioning independently at the clinical workplace (Miller,1990; Tartwijk and Driessen, 2009). Since then portfolios have filled this gap and found their way into medical education, not only as a tool for assessment of performance in the workplace, but also as tools to stimulate learning from experience.

Portfolios that are used in education contain evidence of how learners fulfil tasks and their competence is progressing. Student portfolios are a collection of evidence, prepared by the student and evaluated by the faculty member, to demonstrate mastery, comprehension, application and synthesis of a given set of concepts. To create a
high quality portfolio, students must organize, synthesize and clearly describe their achievements and effectively communicate what they have learned. Despite variations in content and format, portfolios report on work done, feedback received, progress made, and plans for improving competence (Driessen et al., 2007).

Portfolio as a multipurpose instrument:

Portfolio for learning and assessment:

Portfolios that are geared to assess, are organized around all kinds of materials that provide ‘evidence’ of competencies (Miller, 1990; Tartwijk and Driessen, 2009). However, portfolios which foster learning by stimulating learners to reflect and discuss their development, will be organized around learners’ reflections (Miller, 1990; Tartwijk and Driessen, 2009). It also helps to collect evidence that learning has taken place (Collins, 1991). Emphasis has been placed on the implementation of supervision and critical reflection. (Snadden and Thomas, 1998). This works well when it operates through the interaction of a learner and mentor using the material as a catalyst to guide further learning.

Portfolio as a tool for reflection:

A unique aspect of a successful portfolio is that it contains explicit statements of self-reflection. Self-reflections make it clear to the reader the processes of integration that have occurred during the learning process. It is essential that the portfolio does not become a mere collection of events seen or experienced, but also contain critical reflections on those events (Slater, 2017). A portfolio can also stimulate reflection, because collecting and selecting work samples, evaluation of the work done, compels learners to look back on what they have done and analyze what they have and haven’t accomplished.

Portfolio as a tool for effective feedback:

Portfolios can be used to encourage effective feedback sessions by including checkpoints in a training period. For example, an agreement to meet every three months to discuss what is going well, problem areas and how the learner is seen by the colleagues he or she is working with can be extremely helpful to any learner. Alternatively, facilitators can provide feedback for every step the student performs in the clinical setting so that it acts as a guide to reflect upon their strengths and weaknesses (Snadden and Thomas, 1998).

Portfolio as a tool for planning and monitoring:

Portfolios are mostly assembled over a long period. Therefore, they can also be used to support, plan and monitor professional development. One way to do so is to include learning objectives in the portfolio as well as a document trail of related learning activities and accomplishments (Mathers et al., 1999; Oermann, 2002). Therefore, reflections and overviews of personal development have secured a prominent place in many portfolios.

Portfolio as a tool for developing critical thinking and problem solving:

Portfolios are most appropriate when students have to integrate a number of complex ideas, procedures and relationships. The most useful portfolios are composed of student solutions to multifaceted tasks. Such tasks require students to apply, synthesize and evaluate various problem-solving approaches (Slater, 2017).

The purpose of this study was to investigate the improvement in student’s self-reflection, clinical skill (competency) and communication skills in daily clinical practice by introducing portfolio and to know students perception on faculty feedback.

A Randomized controlled trial was planned with Portfolio as the intervention group and traditional logbook as the control group.
The following objectives were formulated for the study:

1. To assess improvement in student’s ability to practice reflective learning in prosthodontics after intervention
2. To compare student’s competency in prosthodontic clinical skills (case history, intra oral examination, primary impression in dentate and edentate patients) in the intervention and control groups
3. To compare student’s communication skills in intervention and control groups based on multi source feedback
4. To compare student perceptions on faculty feedback in intervention and control groups based on a pre-validated questionnaire.
5. To know student perception on portfolio and traditional log book implementations after the study

Methods

The ethical approval was obtained from Research Ethics Committee, Faculty of Dentistry, Melaka-Manipal Medical College. (Ref No: MMMC/FOD/AR/EC 2016 (F-02)). Consent to use the images was obtained from the participants.

The study was divided into three phases:

Phase 1: Development of learning Portfolio

Phase 2: Baseline evaluation using conventional logbook (Control)

Phase 3: Evaluation using learning Portfolio (Intervention)

Phase 1: Development of Portfolio

A focus group discussion was conducted in three sessions to finalise the contents of the portfolio and grading criteria.

Figure 1: Focus group discussion
Focus group discussion to finalize contents of portfolio

![Image of focus group discussion](image)

Item content validity index was calculated by five experts.

**Figure 2: I-CVI Calculation**

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**Validating the contents of Portfolio**

We used the item-level CVI (I-CVI) for content validity. A panel of content experts rated each scale item in terms of its relevance to the underlying construct. 1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, 4 = highly relevant. Then, for each item, the I-CVI was computed as the number of experts giving a rating of either 3 or 4 (thus dichotomizing the ordinal scale into relevant and not relevant), divided by the total number of experts.

| Item | Judge 1 | Judge 2 | Judge 3 | Judge 4 | Judge 5 | I-CVI |
|------|---------|---------|---------|---------|---------|-------|
| No 1 | 3       | 4       | 4       | 4       | 4       | 1     |
| No 2 | 1       | 1       | 2       | 2       | 2       | 0     |
| No 3 | 4       | 4       | 4       | 4       | 4       | 1     |
| No 4 | 1       | 2       | 1       | 4       | 3       | 0.4   |

But as there were only 5 experts giving the rating we followed Lynn’s criteria that “I-CVI should be 1.00 when there are five or fewer judges”. Any score less than 1 had to be deleted.

The moderator discussed the results of I-CVI and the FGD focussed on deletion, modification and substitution to improve the content of the Portfolio.
Study Parameters:

- Reference Population: Students of Melaka Manipal clinical year students
- Source Population: Year 4 students consenting to participate in the study
- Sampling: Purposive sampling
- Sample size: 30
- Study design: Randomized control trial, Mixed research

**Phase 2: Baseline evaluation using conventional logbook**

Faculty and students were trained and sensitized to the proper use of logbook. Allocation concealment and blinding procedures were ensured. The following method was implemented.

**Figure 3: Procedure followed in Conventional Logbook group**
Students in each group repeated the procedure for four weeks. The student competency was assessed using checklist and global index scores. Verbal feedback was given based on their performance in the procedures done.

Assessment of communication skills of the students was done by faculty, peer and Dental Surgery Assistant (DSA) (Multisource feedback) using a pre-validated questionnaire adopted from Joshi et al. (Joshi, R., Ling, F.W. and Jaeger, J., 2004). (Appendix 1)
Students perception on the faculty feedback was assessed using a pre-validated questionnaire adopted from Maurice Hall et al. (Hal, I.M.; Hanna, L.A., and Quinn, S., 2012). (Appendix 2)

**Phase 3: Evaluation using learning Portfolio (Intervention):**

The following method was implemented.

**Figure 5: Procedure followed in Portfolio Group**
Phase 3: Evaluation using portfolio

Sensitization workshop was conducted for students and trained faculty prior to portfolio implementation which included reflective practice and feedback.

The procedures done in the conventional methods were switched between the groups A and B for implementing portfolio.

Group A was assigned procedures X3 and X4
Group B was assigned X1 and X2

Procedure X1 and X2

Procedure X3 and X4

Group B (n=15) Students did 2 must know procedures in Prosth (X1- Dentulous primary impression and X2-case history) and wrote self-reflection on the procedures. Faculty gave written feedback and a score based on checklist and global index score.

Group A (n=15) Students did X3- edentulous primary impression and X4- Post denture insertion instructions) and wrote self-reflection on the procedures. Faculty gave written feedback and a score based on checklist and global index score.
Student's competency was assessed similar to that done in conventional logbook group. Additionally student's self-reflection and written faculty feedback on the student's competency and communication skills were recorded each time after the procedure. The student's reflection was graded using the technique adopted from Wong et al. (Wong, F.K., Kember, D. and Chung, L.Y. 1995) (Appendix 3)

Assessment of communication skills and students perception on the faculty feedback were also collected.

Results/Analysis

Friedman’s test was done to assess improvement in student’s ability to reflect after intervention. Statistically significant difference was found from week two to week four, indicating an improvement in the reflective writing.

Table 1: Friedman’s test to assess improvement in student’s ability to reflect after intervention. (n=30)

| Procedure done      | Reflection Median (Q, Q3) | P value |
|---------------------|---------------------------|---------|
| **Procedure X1 (n = 15)** |                           |         |
| Week 1              | 1.0 (1.0, 2.0)            | 0.001   |
| Week 2              | 2.0 (1.0, 2.0)            |         |
| Week 3              | 2.0 (2.0, 2.0)            |         |
| Week 4              | 2.0 (2.0, 3.0)            |         |
| **Procedure X2 (n = 15)** |                           |         |
| Week 1              | 2.0 (1.0, 2.0)            | 0.005   |
| Week 2              | 2.0 (2.0, 2.0)            |         |
| Week 3              | 2.0 (2.0, 2.0)            |         |
| Week 4              | 2.0 (2.0, 2.0)            |         |
| **Procedure X3 (n = 15)** |                           |         |
| Week 1              | 2.0 (1.0, 2.0)            | 0.019   |
| Week 2              | 2.0 (1.0, 2.0)            |         |
| Week 3              | 2.0 (2.0, 2.0)            |         |
| Week 4              | 2.0 (2.0, 2.0)            |         |
| **Procedure X4 (n = 15)** |                           |         |
| Week 1              | 2.0 (1.0, 2.0)            | 0.003   |
| Week 2              | 2.0 (1.0, 2.0)            |         |
| Week 3              | 2.0 (2.0, 3.0)            |         |
| Week 4              | 2.0 (2.0, 3.0)            |         |

Two way mixed ANOVA of competency scores was done to compare student's competency in the intervention and control groups for all the four procedures over a period of four weeks. There was a statistically significant difference between the groups for all the procedures with portfolio group showing more improvement in competency scores from week one to week four.
Table 2: Two way mixed Anova of competency scores to compare student’s competency in the intervention and control groups for all the 4 procedures over a period of 4 weeks (n=30)

| Procedure done | Conventional log book (n = 15) | Portfolio (n = 15) | P value |
|----------------|-------------------------------|-------------------|---------|
| Procedure X1   |                               |                   |         |
| Week 1         | 17.93 (1.71)                  | 17.27 (1.36)      | 0.002   |
| Week 2         | 19.07 (1.29)                  | 20.80 (1.06)      |         |
| Week 3         | 21.13 (1.97)                  | 22.53 (1.24)      |         |
| Week 4         | 22.00 (1.92)                  | 23.27 (1.99)      |         |
| Procedure X2   |                               |                   |         |
| Week 1         | 21.93 (1.71)                  | 20.47 (1.36)      | 0.001   |
| Week 2         | 22.60 (1.29)                  | 22.40 (1.06)      |         |
| Week 3         | 23.80 (1.97)                  | 24.60 (1.24)      |         |
| Week 4         | 25.47 (1.92)                  | 27.67 (1.99)      |         |
| Procedure X3   |                               |                   |         |
| Week 1         | 16.53 (0.99)                  | 16.47 (1.30)      | 0.001   |
| Week 2         | 18.40 (0.83)                  | 17.33 (1.49)      |         |
| Week 3         | 18.60 (0.99)                  | 19.00 (1.56)      |         |
| Week 4         | 19.33 (1.11)                  | 20.80 (1.57)      |         |
| Procedure X4   |                               |                   |         |
| Week 1         | 21.13 (0.92)                  | 20.13 (0.83)      | 0.001   |
| Week 2         | 22.33 (1.76)                  | 22.80 (1.57)      |         |
| Week 3         | 23.67 (0.90)                  | 24.07 (1.44)      |         |
| Week 4         | 25.13 (1.19)                  | 27.73 (1.49)      |         |

Competency score between Conventional logbook and Portfolio over 4 weeks for procedure X1, X2, X3 and X4 are presented in Graph 1, 2, 3 and 4 respectively.

Graph 1: Competency score between Conventional log book and Portfolio group over 4 weeks for procedure X1
A: Conventional log book; B: Portfolio

Graph 2: Competency score between Conventional log book and Portfolio group over 4 weeks for procedure X2.
Graph 3: Competency score between Conventional log book and Portfolio group over 4 weeks for procedure X3

A: Conventional log book; B: Portfolio
Graph 4: Competency score between Conventional log book and Portfolio group over 4 weeks for procedure X4

A: Portfolio; B: Conventional log book
Wilcoxon signed rank test for the student communication skills in portfolio and traditional logbook using multi source feedback is shown below. A statistically significant difference between the groups was found in faculty and DSA feedback indicating that the portfolio group exhibited better communication skills. However, peer feedback did not show any statistically significant difference for both the groups. Peer feedback for both conventional group and portfolio group was 4 (4,5) p> 0.05 for both the group.

Table 3: Wilcoxon signed rank test for the student communication skills in portfolio and traditional logbook using multi source feedback. (n=30)

| No | Feedback from | Conventional log book | Portfolio | P value |
|----|---------------|------------------------|-----------|---------|
|    |               | Median (Q1, Q3)        | Median (Q1, Q3) |         |
| 1  | Faculty       | 2 (1,3)                | 4 (4,4.25)  | <0.001  |
| 2  | Peer          | 4 (4,5)                | 4 (4,5)    | > 0.05  |
| 3  | DSA           | 2 (2,3)                | 4 (3,5)    | <0.001  |

Wilcoxon signed rank test was used to compare student perception on faculty feedback in the intervention and control groups. Except for one question all other questions showed a statistically significant difference between the groups indicating a better faculty feedback in the portfolio group.

Table 4: Wilcoxon signed rank test to compare student perception on faculty feedback in the intervention and control groups. (n=30)
Eachempati P, Supe A, Tripathi R, Kumar KS K, Kyaw Soe H, Hj Ismail A, Mayya A, Francis Farias A

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| No | Questions                                                                 | Conventional log book Median (Q1, Q3) | Portfolio Median (Q1, Q3) | p value |
|----|---------------------------------------------------------------------------|---------------------------------------|---------------------------|---------|
| 1  | Did the feedback tell how good your work was?                             | 3.0 (2.0, 4.0)                        | 5.0 (4.0, 5.0)            | <0.001  |
| 2  | Did the feedback address areas you need improvement?                      | 3.0 (2.0, 4.0)                        | 5.0 (4.0, 5.0)            | <0.001  |
| 3  | Did feedback help you improve our performance over the weeks              | 3.0 (2.75, 3.0)                       | 4.0 (3.0, 5.0)            | 0.001   |
| 4  | Was adequate amount of feedback given for each procedure?                 | 3.0 (2.0, 4.0)                        | 5.0 (4.0, 5.0)            | <0.001  |
| 5  | Did the feedback help you clarify things you did not understand?          | 3.0 (3.0, 4.0)                        | 4.5 (4.0, 5.0)            | <0.001  |
| 6  | Do you think written feedback is better than verbal feedback?              | 4.5 (4.0, 5.0)                        | 5.0 (5.0, 5.0)            | <0.001  |
| 7  | Could you compare the feedback given over the weeks?                      | 2.0 (1.0, 2.0)                        | 4.0 (4.0, 5.0)            | <0.001  |
| 8  | Was the feedback easy to understand?                                      | 3.0 (2.75, 4.0)                       | 5.0 (4.0, 5.0)            | <0.001  |
| 9  | Was the feedback focused to your needs?                                   | 3.0 (2.0, 3.25)                       | 4.5 (4.0, 5.0)            | <0.001  |
| 10 | Was sufficient time given after feedback so that suggested changes could be implemented in the next piece of work? | 4.0 (4.0, 5.0)                        | 4.0 (4.0, 5.0)            | 0.527   |

Spearman’s correlation showed a negative correlation between the feedback, reflection and competency scores. However, the results were not statistically significant.

**Table 5: Spearman’s correlation between feedback, reflection and competency scores. (n=30)**
Qualitative analysis of the student perceptions on portfolio implementation was done using the thematic analysis by Braun and Clark. (Clark, V and Braun, V, 2013)

Five themes were generated.

1. Reflections - Clarity of thoughts
2. Feedback
3. Recollection
4. Improvement in performance
5. Strengths and weakness

**Discussion**

We adopted the technique given by Wong, et al. (Wong, et. al., 1995) to grade the student's into reflectors, non-reflectors and critical reflectors. Over the period of four weeks, there was a gradual increase in the number of reflectors and critical reflectors similar to our reference study (Wong, et al., 1995). These results could be attributed to the influence of an effective written feedback, which is the strength of portfolio (Snadden, D and Thomas, M.L, 1998).

Competency of four procedures were assessed in the current study and in an attempt to establish reliability of the results, the procedures were repeated and assessed weekly for four weeks period in both the groups. The results showed a significant improvement in the portfolio group over the four weeks and this could be due to the written feedback by the faculty and self-reflection by the students. Tochel C et al. (Tochel et al., 2009) reported a systematic review on the effectiveness of using portfolios. In this article the author discusses that according to Kirkpatrick’s Hierarchy (McCullan et al., 2003), most included studies were found to impact on the learning of the portfolio user (a level 2 impact). This indicates that, the reflections and feedback help to bring about a modification of knowledge/skills relating to acquisition of concepts, procedures and principles.

Multi source feedback regarding the communication skills was rated higher in the portfolio group compared to the conventional group by the DSA and faculty. These results could be attributed to the self reflection of the student and a written feedback by the faculty. This is supported by the systematic review by Tochel C et. al. (Tochel et. al, 2009) who reported studies showing an improvement in the attitude and perception of the students due to the component of self reflection and feedback.
The qualitative analysis of the students revealed that they had an opportunity to relook into the previous week's reflection and comments before beginning the procedure thereby taking care not to repeat the mistakes done earlier. Peer feedback did not show any statistical difference and was rated high in both the groups. As reported by Robinson (Li, L and Gao, F, 2016) this could be because some students feel uneasy and reluctant to assess their peers' work and 'marking could be easily affected by friendship, cheating, ego or low self-esteem'. Hence the rating is same for both the groups and consistently high (Driessen et. al, 2005)

Students felt the need for an elaborate written feedback from faculty, which was possible in the portfolio group. The results reflect the same showing a better satisfaction rate for the portfolio group.

We tried to correlate the three components: reflective writing, competency scores and communication skills by using the Spearman's correlation. However, no correlation was found between any of the parameters. With the small sample we have in the study, establishing correlations between the different parameters may be difficult. This aspect could be looked into in future studies.

Qualitative analysis revealed five main themes. The students felt that through self-reflection they had better clarity of thoughts. The written feedback provided by the faculty was very helpful to identify the areas they needed improvement. They opined that before starting the procedure they had an opportunity to relook into the previous week's mistakes and feedback which helped them avoid the same. The tips given by lecturers could be implemented effectively due to the possibility of reading the written feedback a number of times. This automatically led to an improvement in their performance in contrast to the traditional logbook group where verbal feedback is easily forgotten. The students perceived that they were able to better identify their strengths and weakness through self-reflection and feedback.

**Conclusion**

1. There was a statistically significant improvement in student's ability to practice reflective learning in prosthodontics after intervention.
2. Student's competency in prosthodontic clinical skills (case history, intra oral examination, primary impression in dentate and edentate patients) in the intervention group was better than the control group and statistically significant.
3. Faculty and DSA feedback on communication skills showed a statistically significant difference with the portfolio group showing better results.
4. Portfolio group showed better scores for student perceptions on faculty feedback than the control group and the results were statistically significant.
5. Five themes were generated by qualitative analysis of student perceptions on portfolio implementation and showed a positive impact.

**Take Home Messages**

With the results obtained in our study, portfolio has a significant impact on student competency in selected prosthodontic procedures and communication skills. Over the four weeks period a drastic improvement in the reflective skills was also noted. The main strength of the study lies in reflective learning which is a way of allowing students to step back from their learning experience to help them develop critical thinking skills and improve on future performance by analyzing their experience. The explosive growth of learning portfolios in higher education as a compelling tool for enhanced student learning, assessment, and career preparation is a sign of the increasing
significance of reflective practice and mindful, systematic documentation in promoting deep, meaningful, transformative learning experiences. Student perceptions regarding implementation of portfolio in the curriculum is encouraging.

Notes On Contributors

Prof. Prashanti Eachempati: Conceived design and implementation of the study. Designed and performed the study. Interpretation of the results and to the writing of the manuscript. Drafting and revising the final work. Final approval of the version to be published.

Prof. Avinash Supe: Contributed to design of the study.

Dr. Raakhi Tripathi: Contributed to design of the study.

Dr. Kiran Kumar KS: Assistance in performing the study. Drafting and revising the final work.

Prof. Htoo Htoo Kyaw Soe: Data Analysis.

Prof. Abdul Rashid Hj Ismail: Contributed to design of the study.

Dr. Anoop Mayya: Drafting and revising the final work.

Dr. Anand Francis Farias: Drafting and revising the final work.

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Appendices

**Appendix 1: Multisource feedback**

| Evaluator Questionnaire |
|-------------------------|
| 1. Resident introduces himself/herself to you when meeting you for the first time |
| 2. Resident listens attentively to you during interactions/conversations especially regarding patients |
| 3. Resident interrupts you during conversation |
| 4. Resident is courteous and polite when called/answering beep |
| 5. Resident shows respect to you as a “team member” |
| 6. Resident gives consideration to your views, suggestions, and opinions |
| 7. Resident explains rationale of his/her plan/actions to you |
| 8. Resident answers your doubts or questions politely |
| 9. Resident communicates orders clearly to you verbally or in writing |
| 10. Resident apologizes to you for inappropriate behavior on his/her part |
*Statements were rated on a five-point scale: 1 never, 2 rarely, 3 sometimes, 4 frequently, and 5 always. For Statement 3, the five-point scale was reversed: 5 never, 4 rarely, 3 sometimes, 2 frequently, and 1 always. The statements on the questionnaires for other evaluators (faculty, colleagues, medical students, ancillary staff, and patients) were similar but were tailored to reflect the resident’s specific interactions with that category of evaluator.

Appendix 2: Perception of feedback

**Perception of student on faculty feedback**

1. Did the feedback tell you how good was the work?
2. Did the feedback address areas you need improvement?
3. Did the feedback help you improve your performance over weeks?
4. Was adequate amount of feedback was given for each procedure?
5. Did the feedback help you clarify thing you did not understand?
6. Do you think written feedback is better than verbal feedback?
7. Could you compare the feedback given over weeks?
8. Was the feedback easy to understand?
9. Was the feedback focused to your needs?
10. Was sufficient time given after the feedback so that suggested changes could be applied in the next piece of work?

*Statements were rated on a five-point scale: 1: Strongly Disagree, 2: Disagree, 3: Nether agree nor disagree, 4: Agree, 5: Strongly Agree*

Appendix 3: Reflective writing score criteria

| Category               | Explanation                                                                 | score |
|------------------------|-----------------------------------------------------------------------------|-------|
| Non reflective thought | Mere summary of the week and no personal reflection beyond summary          | 1     |
| Reflective thought seen| Awareness of observations, judgements and description and an ability to assess decisions and plans - Student explains what he has learnt and what he needs to learn | 2     |
| Critical reflection seen| Student is aware that their routine schemata are adequate with the need for a different perspective stemming from an understanding of necessity for further learning Student explains what he has learnt and where improvement is needed. He also reflects on further actions he intends to take | 3     |

**Declarations**

The author has declared that there are no conflicts of interest.

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Ethics Statement

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