Evaluating a Specific Mentoring Intervention for Preservice Teachers of Primary Science

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Abstract:

Using a two-group posttest only design, 60 final year preservice teachers (control group) and 12 final year preservice teachers (intervention group) from the same university were compared after a four-week professional experience program. The intervention group received a mentoring program for developing primary science teaching practices. The survey measured both the control group and intervention group perceptions of their mentoring in primary science across previously established mentoring factors (i.e., personal attributes, system requirements, pedagogical knowledge, modelling, and feedback). Results indicated that those in the intervention group perceived they had received more mentoring experiences on each of the five factors, and ANOVA results indicated that these differences were statistically significant for the first four of the five factors. It is argued that the specific mentoring intervention designed for developing specific aspects of primary science teaching has the potential to enhance the degree and quality of teaching experiences within a preservice teacher's professional experiences.

Primary science education reform has long been perceived as a problem (Burry-Stock & Oxford, 1994; Bybee, 1997; Tytler, Conley, Sharpley, & Waldrip, 2000). This problem has been identified in England (Lunn & Solomon, 2000), Australia (Goodrum, Hackling, & Rennie, 2001), and in the United States (National Commission, 1996; Gallagher, 2000). As enhancing science teaching practices appears to be a key focus for reform, science education of preservice primary teachers in modern science teaching practices is seen as a "critical component in the systemic approach necessary to make real and lasting change a classroom reality" (Raizen & Michelson, 1994, p. 7). However, while it is evident that science teaching practices have changed little despite reform efforts (Goodrum et al., 2001; Hernandez, Arrington, & Whitworth, 2002; Tobin, Tippins, & Hook, 1994), reform efforts must continue to target "the improvement of teacher practices in all teachers" (Riggs & Sandlin, 2002, p. 15), and this includes preservice teachers. Indeed, science teacher preparation is considered a key part of systemic reform in the United States (Yager, 1996).

The professional experience practicum has taken on further importance in the recent literature on preservice teacher education (Power, Clarke, & Hine, 2002). It has become more school-based and has "increased the responsibilities" assigned to mentors (Sinclair, 1997, p. 309). Mentoring provides opportunities for preservice teachers to "learn from and with others and engage in the co-construction of meanings" (Beattie, 2000, p. 4). Indeed, mentoring is a collaboration between mentors (supervising or cooperating teachers) and mentees (preservice teachers), and is considered to be one avenue for implementing educational reform measures (Crowther & Cannon, 1998).

However, the quality of mentoring is also a concern, as despite the importance placed on mentoring preservice teachers, there are numerous educators who have outlined the inadequacy of mentoring from tertiary educators and school-based mentors (e.g., Gaffey, Woodward, & Lowe, 1995; Long, 1997; Zeichner, 2001). Mentors need to thoughtfully organise preservice teachers' professional experiences, which requires an awareness of mentoring practices that may affect their mentees' performances. For example, Carlson and Gooden (1999, pp. 5-7) claim a major factor in mentoring preservice teachers is "the behavior of those near them who are in instructional or supervisory roles," and that an effective way to encourage assimilation of teaching skills is for mentors to model teaching practices. Obviously, this can be difficult if the mentor is not experienced in modelling specific teaching practices, such as those associated with a reformed view of science education.

Wideen, Mayersmith, and Moon (1998) note that preservice teacher intervention programs have the potential appear to change preservice teachers' beliefs about teaching. This is particularly pertinent if effective practice is derived from "beliefs about teaching and learning" (Tobin, Tippins, & Gallard, 1995, p. 54). Further, change in teaching practices is unlikely to happen unless intervention programs are developed (Shayer, 1991). To this end, mentors within intervention programs that are designed to change preservice teachers' beliefs about teaching and learning may "be seen as important agents of change" (Edwards & Collison, 1996, p. 134).

Educators need to take affirmative steps towards achieving the key goals of primary science education reform, which includes the implementation of specific mentoring strategies to promote this reform. Even though there is limited empirical evidence of successful mentoring interventions in primary science teaching, mentors who have trialled science mentoring material feel more confident in raising issues, expect specific learning outcomes, place greater emphasis on pedagogical knowledge, and improve their own skills of observation (Jarvis, McKeon, Coates, & Vause, 2001). Just as "effective instructional strategies enable teachers to be able to teach for conceptual change and understanding" (Kyle, Abell, & Shymansky, 1992, p. 33), so too can specific mentoring strategies in the field of science education aid the development of preservice teachers' understanding of primary science education. Further, research is needed to "examine mentors' actual performance as mentors in relationship to the mentor preparation they receive" (Riggs & Sandlin, 2002, p. 14).

The mentoring component of this study builds upon two decades of research (e.g., Edwards & Collison, 1996; Little, 1990; Loucks-Horsely, Hewson, Love, & Stiles, 1998; Schon, 1983), and takes into account the research conducted on self-efficacy by Bandura (1981, 1986, 1997), Enochs and Riggs (1990), and Pajares (1992), and the theory of constructivism (e.g., von Glasersfeld, 1989, 1998). In particular, this study builds upon the findings of Ganser (1991, 1996, 2000), Kesselheim (1998), and Jarvis et al. (2001) in relation to mentoring and primary science teaching. This last study in particular, is currently exploring specific mentoring strategies in primary science preservice education. However, sequential and systematic development of specific mentoring in primary science teaching is yet to be devised, implemented, and evaluated.

The mentoring intervention employed in this study aimed to develop the mentor's mentoring knowledge and skills of primary science teaching and, simultaneously, enhance the mentee's primary science teaching. It (referred to in the field as the "mentoring program") was designed to be collaborative with the provision of specific mentoring strategies on developing teaching and learning strategies in primary science teaching (Hudson & Skamp, 2003).

The aim of this study was to investigate perceptions of mentees and mentors about mentoring practices in primary science teaching. More specifically, to:

1. compare perceptions of final year preservice teachers involved in a specific mentoring intervention (i.e., a mentoring intervention designed to facilitate the development of specific mentoring strategies) with those who are involved in current mentoring practices typically found in professional experiences; and,
2. investigate mentors' perceptions of this specific mentoring program.

Design and Methods

The study reported here is part of a larger study investigating mentoring in preservice primary science teaching. This component of the study was a mixed method design with a randomised two-group posttest only design (control group and intervention group) investigating the perceptions of mentees' mentoring in primary science teaching through a validated survey instrument after their professional experiences. The intervention design adhered to the principles outlined by Rothman and Thomas (1994). The design also included interview data on mentors' perceptions of the mentees' development as primary science teachers and their reflections on the mentoring program. Mentoring in this study was investigated through a constructivist perspective on learning how to teach primary science.

The "Mentoring for Effective Primary Science Teaching" (MEPST) instrument in this study evolved through a series of preliminary investigations on mentoring for effective primary science teaching. Steps for developing and validating the instrument included small-scale interviews with mentors and mentees (*n*=10) on their perceptions of mentoring preservice primary science teaching at the conclusion of a three-week professional experience. Development and trial of a preliminary survey based on the literature and previous interviews was piloted on 21 first-year preservice teachers and later with 59 final year preservice teachers at the conclusion of their professional experiences. The content of each survey item included a statement that: (1) contained a literature-based mentoring skill or practice or behaviour that could be recognised in a word or phrase; and (2) allowed a complete response to the item on a 5-point Likert scale. To further substantiate the instrument's validity, five specialists (one in the field of science education, one in the field of mentoring, one in the field of survey construction, and two statistical analysts) examined the items on the proposed survey.

The results of these preliminary studies led towards the development of a 45-item survey with five postulated factors (i.e., personal attributes, system requirements, pedagogical knowledge, modelling, and feedback). This survey was then administered to final year preservice teachers (331 complete responses) from nine Australian universities at the conclusion of their professional experiences. Five factors were confirmed through confirmatory factor analysis with each factor having a Cronbach alpha reliability greater than .70 (i.e., "Personal Attributes"=.93, "System Requirements"=.76, "Pedagogical Knowledge"=.94, "Modelling"=.95, and "Feedback" =.92). The final theoretical model produced good "goodness of fit" indices (?^{2}=1335, *df*=513, CMIDF=2.60, IFI=.922, CFI=.921, RMR=.066, RMSEA=.070; p<.001), which further supported the five-factor model. As a result of this analysis, various items were reassigned to more appropriate factors and unsatisfactory performing items were omitted resulting in a final 34-item instrument (Appendix 1). The 34 survey items used a Likert scale for response categories, namely, "strongly disagree," "disagree," "uncertain," "agree," and "strongly agree." Scoring was accomplished by assigning a score of one to items receiving a "strongly disagree" response, a score of two to "disagree" and so on through the five response categories.

Development of a Mentoring Intervention Program

A mentoring intervention program was constructed to reflect the development of the factors and associated items contained in the final survey (Appendix 1, MEPST). This mentoring program focused on developing mentees' primary science teaching practices by employing specific mentoring strategies. Each item on the mentoring program provided literature background information and suggested strategies that aimed to target the particular survey item. For example, Item 32 states, "During my final professional school experience (i.e., internship/practicum) in primary science teaching my mentor showed me how to assess the students' learning of science." Mentoring strategies associated with this item included: linking assessments to outcomes, making references to the syllabus, and demonstrating an assessment procedure (e.g., see Figure 1).

Assessing the students' learning of science

Background information:
• A mentor with knowledge of assessment methods of science teaching can assist the mentee in sequential and purposeful planning for the teaching of science (Corcoran & Andrew, 1988).
• Gilbert and Qualter (1996) emphasise the importance of assessment for teaching and learning activities within the science curriculum.
• Conducting an assessment of students is addressing a system requirement (Kahle, 1999).
• Mentors need to help mentees "use and respond to a variety of appropriately designed assessments at the beginning of new science topics as well as throughout the teaching process" (Jarvis, et al., 2001, p. 10).

Strategies:
† Tell the mentee that assessments of students are related to the learning outcomes of a science lesson(s). Refer the mentee to the syllabus.
† Demonstrate how you would assess students' learning on a science lesson you had just taught, and show how you would record the students' progress, e.g., checklist.

Figure 1: Example of background literature relating to an item and associated mentoring strategies.

Sample and Procedure

Seventy-two mentors were randomly partnered with final year preservice teachers by university administrative staff. Within this cohort, 12 mentors and their respective mentees were randomly selected as the intervention group and the remainder constituted the control group. Immediately after the conclusion of the four-week professional experience, mentees completed the MEPST instrument and interviews were conducted with mentors.

Descriptors of the final year preservice teachers in the control group (n=60) included: 28% had entered teacher education straight from high school, with 42% completing high school biology and 17% completing high school physics; 87% had completed one science methodology unit at university; and, 80% had completed four professional school experiences spanning a total of 100 days or more over a four-year period.

Key descriptors of the final year preservice teachers in the intervention group (n=12) included: 42% had completed high school biology units and 17% completed high school physics (the same percentages as the control group); 92% of students had completed four professional school experiences spanning a total of 100 days or more over a four-year period, and the same percentage had completed one science methodology unit at tertiary level. The important difference between the groups is that all mentees in the intervention group had taught four or more science lessons during their last four weeks of professional experience, which was guided by a specific mentoring intervention in primary science teaching.

Mentors (*n* =60) in the control group varied in their background and behaviours. Sixty-five percent of mentors were over 40 years old, with only 6% under 30 years of age. Forty-seven percent of mentees indicated that they were undecided as to whether their mentors were interested in science. Twenty percent of mentors did not model a science lesson during their mentees' practicum experiences.

Mentors (*n* =12) in the intervention group also varied in their background and behaviours. Eighty-three percent of mentors were over 40 years old with 8% under 30 years of age. An important difference between the groups is that all but one mentor in the intervention group modelled a science lesson during the mentee's professional experience. Nevertheless, all mentors in the intervention group employed predetermined specific mentoring strategies to guide the mentees' primary science teaching.

Results

An ANOVA was conducted on the survey results comparing the mean scores on each of the previously identified factors for the intervention and control groups. Table 1 reports the mean scores and standard deviations (SD) on each of the five factors for the control and intervention groups along with the results of an independent sample *t*-test comparing the mean scores for each group. This table shows that there were statistically significant differences in mean scores in the control and intervention groups on four of the five factors, with the latter group having a higher mean score on each factor. The difference in the mean scores on "Feedback" was not statistically significant

(p<.05), although the intervention group still scored higher than the control group on this factor.

Table 1

Descriptive Statistics, ANOVA Comparisons, and Effect Sizes of the Five Factors for Control and Intervention Groups

	Control (n=60)		Intervention (n=12)				
Factor	Mean	SD	Mean	SD	Mean differences	Effect size	t (df=70)
Personal Attributes	3.42	1.11	4.00	0.62	0.58	0.55	1.76*
System Requirements	2.40	1.02	4.14	0.86	1.74	1.47	5.53**
Pedagogical Knowledge	2.88	1.07	3.67	0.50	0.79	0.76	2.48*
Modelling	3.18	1.02	3.81	0.62	0.63	0.64	2.06*
Feedback	3.30	1.10	3.85	0.81	0.54	0.51	1.62

** p<.01, * p<.05

Further, Table 1 reports calculations of the effect size of the difference in mean scores between the two groups. In educational contexts, “Effect sizes of .20 are considered small; .50, medium; and, .80, large” (Hittleman & Simon, 2002, p. 178). The largest effect size [*d*] was evident with “System Requirements.” For the intervention group the mean score was 4.14, while the control group mean score was 2.40, which indicated a very large effect size in favour of the intervention group (*d*=1.47). The effect size was also considered large for “Pedagogical Knowledge” with a control group mean score of 2.88 and an intervention group mean score of 3.67 (*d*=.76). “Personal Attributes” and “Modelling” would be classified as at least medium effect sizes (*d*=.55 & *d*=.51, respectively; Table 1). In this preliminary small-scale comparison, it appears that the mentees' perception of the specific mentoring intervention was statistically and educationally significant on four of the five factors. In addition, these perceptions of the mentoring experiences received were supported by interview data from mentors involved in the intervention group, as will be discussed in the next section.

Mentors' Perceptions of the Specific Mentoring Intervention

Interview data from mentors were analysed for common and divergent themes about general perceptions of the intervention program, specific perceptions of the effectiveness of the mentoring strategies linked to the five factors, and the mentors' perceptions of the program's success.

Firstly, the mentors and mentees' roles were specified within the intervention program procedures, which needed to be clear and attainable so that the participants felt comfortable within their roles. These points were reflected in Mentor 3's comment, "she [the mentee] felt comfortable because of the way it was set out and the guidelines that were given. It's not a test. She felt comfortable with that."

Secondly, the mentoring sessions were designed to promote discussion on science teaching practices across the five proposed factors towards developing the mentee's practices. These sessions were claimed to be "thorough" (Mentor 11), and "clear and concise" (Mentor 2). Mentor 4 stated, "You could really get things pinpointed down to exactly what you needed to find out and what you had to do to go about trying to improve things with the mentee." Further, the five factors were considered by mentors as providing clear guidance for mentoring in primary science education. For example, Mentor 1 stated, "I think it's [points to the five factor model within the mentoring program] a very important part of the process. It reminds you what is actually a part of the program." When asked if there was a need to clarify any term or issue within the mentoring intervention, two mentors stated "Pedagogical Knowledge" required clearer explanation, as this term may not be widely used in the primary education system. Nevertheless, all mentors agreed that the items were relevant to the factors, even though they may not have known the literature associated with each item. For instance, Mentor 2 stated:

> I agree they [points to the items that are associated with a factor] fit in with science. I was reading through them and I don't know Williams and I don't know Tobin and Fraser but I agree with the things that are there and the strategies that go with them.

Thirdly, the strategies within the mentoring intervention presented a practical focus for developing the mentee's primary science teaching. Mentors provided evaluations of the effectiveness of the strategies that were linked to each factor within the mentoring intervention. For example, Mentor 14 claimed that the mentoring strategies assisted "to make sure that you're on target." According to Mentor 1, the strategies "made mentoring more focused on what I was trying to get across to her [the mentee] in specific areas of help with her, and particular pointers that she could maybe improve upon in the next lesson on." Mentor 5 stated, "There was enough detail that allowed me to reflect on what I was supposed to be doing." Mentors also commented specifically on various mentoring strategies. For example, the mentor-modelled science lesson allowed the mentee to reflect on the mentor's practices such as planning, preparation, procedures, and classroom management for effective science teaching. Mentor 8 claimed that this strategy allowed the mentee "to focus on certain things when she is doing in her own teaching. I think that gave the mentee a bit of empowerment."

Fourthly, and most importantly, several mentors reported that the mentees' confidence in teaching primary science had increased because of the mentoring intervention. For example, Mentor 4 noted that because of the intervention her mentee "felt very comfortable, and [I am] very confident that she would be able to teach science when she goes out." Indeed, mentors clearly articulated the success in this intervention program for both the mentees and mentors' development. To illustrate, Mentor 11 claimed that her mentee was developing as a primary science teacher through the intervention program and that she "was getting results with [her] mentoring." Mentor 5 stated, "I felt that there was a strong impact on the student teacher's [mentee's] performance. The student [mentee] was better planned and organised because of these strategies." And as a program for developing mentors, Mentor 12 stated, "It made me pick up the syllabus again and re-read it". Similarly, Mentor 9 declared, "It made me think about science a bit more and how I should be doing it. It helped me to participate in science."

Finally, some analysis of the survey items provided information about the mentors in the intervention group, for example, 17% of mentees were "unsure" if science was a strength of these mentors, while the rest indicated that they either "disagreed" or "strongly disagreed" that the mentor had a strength in science. Nevertheless, all mentors in the intervention group had previously mentored preservice teachers, with 75% of these mentors mentoring four or more preservice teachers during their career.

Discussion

It is argued in this study that each of the five key factors underpinning effective mentoring in primary science teaching, (namely: personal attributes, system requirements, pedagogical knowledge, modelling, and feedback), has associated mentoring practices that may aid in the development of preservice teachers' primary science teaching (see also Hudson, Skamp, & Brooks, submitted). These practices associated with the five factors have the potential to promote more effective science education and become a vehicle for implementing primary science education reform.

By comparing the perceptions of final year preservice teachers involved in a specific mentoring intervention with those who were involved in current mentoring practices typically found in professional experiences provided preliminary confirmation of the possible successfulness of a specific mentoring program. Investigating mentors' perceptions of this specific mentoring program also provided initial evidence that such a program may have a positive effect on teaching and mentoring practices. Mentees indicated that mentors involved in the intervention provided more mentoring in the specific mentoring practices associated with each of the five factors (see Table 1). This also suggests that the provision of a more detailed mentoring framework to guide mentors may facilitate the inclusion of specific mentoring strategies in professional experiences.

"System Requirements" are considered an essential component for primary science education reform (see Bybee, 1997), especially as education continually changes and relies upon the implementation of system documents for uniformity of change. Reform measures are required for more effective primary science teaching, which requires a hands-on approach (Vesilind & Jones, 1996). The results from the specific mentoring intervention indicated that the mentees' perceptions of their mentoring of "System Requirements" were enhanced considerably. This study argues that if the implementation of system requirements is an element of reform then a specific mentoring intervention that guides mentors for improving mentees' knowledge of system requirements has the potential for contributing to implementing primary science education reform.

Providing mentees with "Pedagogical Knowledge" is at the centre of developing teaching practices within a mentoring relationship (Jarvis et al., 2001; Kesselheim, 1998). This specific mentoring intervention appeared to significantly increase the mentee's reception of "Pedagogical Knowledge" practices from mentors, which augments the value and quality of the mentoring partnership (e.g., see Mulholland, 1999). This study argues that without providing a specific direction on effective mentoring practices, mentoring may be largely a "hit and miss" process. A specific mentoring intervention, as outlined in this study, can focus the mentoring processes towards providing continuity and uniformity of mentoring practices. In addition, a specific mentoring program may aid mentors in providing necessary mentoring skills and knowledge for teaching primary science so that all mentees are targeted and not just those who are fortunate enough to have a primary science teaching-mentor. This study argues that a specific mentoring intervention may at least reduce the prevalence of inadequate or non-existent mentoring in primary science teaching, which includes the development of "Pedagogical Knowledge," towards progressing the mentee's knowledge and skills in order to effect science education reform.

Knowing how to teach requires first-hand experiences (Jarrett, 1999), and the mentor who can model (Carlson & Gooden, 1999), provide pedagogical knowledge (Barab & Hay, 2001), and articulate feedback on practices (Bishop, 2001) can more readily scaffold the mentee's development as a primary science teacher. Remarkably, nearly all mentors in the intervention group modelled primary science teaching practices despite their apparent lack of expertise in primary science. In this way, primary science education reform is targeting teachers and preservice teachers simultaneously.

Feedback from mentors aids the mentees to reflect upon teaching practices (Beattie, 2000; Schon, 1983). Even though the differences in mentoring practices within "Feedback" for primary science teaching in this study were considered as not statistically significant, mentees perceived there was more mentoring in this area than in the control group.

It should be emphasised that a specific mentoring intervention provides guidelines for developing primary science teaching practices; however the mentor needs to have the flexibility to cater for the mentee's needs. Kesselheim (1998, p. 8) notes that mentoring "assistance was most useful when it possessed a feature of immediate application." This means that a mentee who requires further mentoring in one specific area needs to be afforded appropriate scaffolding by the mentor. Regardless of how well planned a mentoring intervention may be, contingent mentoring allows for individual learning. Part of contingent mentoring is addressing the mentee's needs as they arise.

The qualitative results of the specific mentoring program in primary science teaching implemented in this study suggested that there was some evidence of improved primary science teaching practices for mentees. If changing practices are required for science education reform then specific mentoring may create a shift in the way in which both mentors and mentees teach primary science towards achieving science education reform. A specific intervention may be used to sequentially and constructively mentor preservice teachers within a relatively short professional experience period. While this study has demonstrated increased perceptions of mentoring practices because of a specific intervention, this study does not examine the improvement of primary science teaching practices as a result of this intervention; hence a larger study will be required to validate the long-term effects of specific mentoring for enhancing both mentors and mentees' practices.

Conclusion

The literature suggests that there is considerable potential for mentoring to bring about reform. Yet, the literature also indicates that there have been few programs on specific mentoring in primary science teaching. This study has evaluated a specific mentoring intervention in primary science education derived from the literature and pilot studies, and has shown that specific mentoring involving five factors and associated practices can positively affect the mentees' perceptions on the amount of mentoring they receive. It also appears that the mentors' confidence in their mentees for teaching science and their confidence in their own mentoring practices may be enhanced. While further studies are needed to determine the improvements in actual teaching practices, this study demonstrates the potential of a specific mentoring program to bring about the much needed reform in primary science education.

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Appendix 1

Mentoring for Effective Primary Science Teaching (MEPST)

(Hudson, Skamp & Brooks, 2003)

(To be administered at the conclusion of the mentoring program)

The following statements are concerned with your mentoring experiences in primary science teaching during your last practicum/internship. Please indicate the degree to which you agree or disagree with each statement below by circling your response to the right of each statement.

Key

SD = Strongly Disagree
D = Disagree
U = Uncertain
A = Agree
SA = Strongly Agree

During my final professional school experience (i.e., internship/practicum) in primary science teaching my mentor:

1. was supportive of me for teaching science. ………………………… SD D U A SA
2. used science language from the current primary science syllabus. SD D U A SA
3. guided me with science lesson preparation. …………..…………. SD D U A SA
4. discussed with me the school policies used for science teaching. .. SD D U A SA
5. modelled science teaching. ……………………………………… SD D U A SA
6. assisted me with classroom management strategies for science teaching. SD D U A SA
7. had a good rapport with the primary students doing science. …… SD D U A SA
8. assisted me towards implementing science teaching strategies. …. SD D U A SA
9. displayed enthusiasm when teaching science. ……………………..… SD D U A SA
10. assisted me with timetabling my science lessons. ……………….. SD D U A SA
11. outlined state science curriculum documents to me. ……………. SD D U A SA
12. modelled effective classroom management when teaching science. SD D U A SA
13. discussed evaluation of my science teaching. …………………….. SD D U A SA

14. developed my strategies for teaching science. ……………………	SD	D	U	A	SA
15. was effective in teaching science. …………………………………	SD	D	U	A	SA
16. provided oral feedback on my science teaching. …………………..	SD	D	U	A	SA
17. seemed comfortable in talking with me about science teaching. ….	SD	D	U	A	SA
18. discussed with me questioning skills for effective science teaching.	SD	D	U	A	SA
19. used hands-on materials for teaching science. …………………….	SD	D	U	A	SA
2. provided me with written feedback on my science teaching. ……	SD	D	U	A	SA
21. discussed with me the knowledge I needed for teaching science. ..	SD	D	U	A	SA
22. instilled positive attitudes in me towards teaching science. ………	SD	D	U	A	SA
23. assisted me to reflect on improving my science teaching practices.	SD	D	U	A	SA
24. gave me clear guidance for planning to teach science. ……………	SD	D	U	A	SA
25. discussed with me the aims of science teaching. ………………….	SD	D	U	A	SA
26. made me feel more confident as a science teacher. ………………	SD	D	U	A	SA
27. provided strategies for me to solve my science teaching problems.	SD	D	U	A	SA
28. reviewed my science lesson plans before teaching science. ……….	SD	D	U	A	SA
29. had well-designed science activities for the students. …………….	SD	D	U	A	SA
3. gave me new viewpoints on teaching primary science. …………..	SD	D	U	A	SA
31. listened to me attentively on science teaching matters. …………..	SD	D	U	A	SA
32. showed me how to assess the students' learning of science. ……..	SD	D	U	A	SA
33 clearly articulated what I needed to do to improve my science teaching. …	SD	D	U	A	SA
34. observed me teach science before providing feedback? …………..	SD	D	U	A	SA