Investigating the Pre-service and In-service Science Teachers’ Conceptions of A ‘teacher’ at the Beginning of Their Initial Teacher Training Program

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Abstract. This study is an on-going research that aims to explore pre-service and in-service teachers’ conception of ‘a teacher’ at the beginning of their initial teacher training program. This particular study administered an open ended questionnaire that consists of 4 questions to 13 pre-service science teachers and 7 in-service science teachers during the first session of the initial teacher training programme. The open-ended questionnaire explores the teachers’ conception of what makes a teacher, a good teacher, an excellent teacher and a 21\textsuperscript{st} century teacher. A thematic analysis was conducted by two researchers in order to ensure trustworthiness of the emerging themes that emerged found from the data. One of the potential contributions from the findings of this research is the discourse of how pre-service and in-service science teachers’ construct their conceptions on the different dimensions of a teacher i.e. from good to a 21\textsuperscript{st} century teacher.

1. Introduction
This study is driven with aims to bring benefit and improvement in preparing both pre-service and in-service science teachers during their teacher training. The findings of this on-going study are hoped to unpack the discourse among these prospective science teachers on their conceptions of what makes a teacher, a good teacher, an excellent teacher and a 21\textsuperscript{st} century teacher.

Loughran [1] indicated that prospective teachers enter teacher preparation with experiences they have experienced as students. This can be considered as students’ perspective whereas once they enter teacher preparation, the prospective teachers are challenged to view their thinking from teachers’ perspective. These prospective teachers’ perspective could be shaped by their personal identity and belief [2, 3, 4, 5]. In science education, teachers’ practices are expansively explained as influenced by their beliefs [2] Hence, recognition of the prospective teachers’ belief would help to provide teacher educators to openly discuss and intentionally confront and challenge as well as define and redefine the prospective teachers’ views on what constitute good and effective teaching and practices.

It is essential that not only the beliefs of the prospective teachers to be acknowledged but also the role of identity and their knowledge about teaching as well as subject and pedagogical content knowledge [6, 7, 8, 9, 10]. Teachers are inclined to focus on their subject knowledge which are then reflected on how they carry out their roles and hence their identities [7]. Thus it is central to see the relationship between teachers’ practices and identities [11].

Hence, this study is hoped to better understand teachers’ conceptions of what makes a ‘teacher’ through exploring their views at the onset of joining the programme. This will be a continuous study by accessing their conceptions during the middle and towards the end of the programme. There are two main research questions formulated for this study which are:
Research question 1: What are the pre-service and in-service teachers’ conceptions of different categories of ‘a teacher’?

Research question 2: What are the dominant themes for the different categories of ‘a teacher’?

2. Methodology

The study administered an open-ended questionnaire to 20 science teachers during the first session of their initial teacher training programme. Their responses to the questionnaire were used as the main source of data. This study employed a qualitative and quantitative approach to analyse the data. In terms of qualitative approach, a thematic analysis was used. As to quantitative approach, a simple tally of the recurrence of a theme was utilised.

2.1. Participants

20 science teachers were involved in this study i.e. 13 pre-service science teachers and 7 in-service science teachers. The in-service science teachers have a range of one to four years of teaching experience in schools.

2.2. Questionnaire

The questionnaire consisted of 2 main questions. The first main question consisted of 3 sub-questions. These questions were developed to elicit the science teachers’ view on what makes (i) a teacher, (ii) a good teacher, (iii) an excellent teacher and (iv) 21st century teacher.

3. Findings

8 themes emerged from the overall data collected. There were (i) delivery of necessary content, (ii) awareness of students’ capabilities and academic achievement, (iii) ability to explain concepts, (iv) pedagogical versatility, (v) memorisation, (vi) effort and commitment, (vii) sense of responsibility for future generation and (viii) becoming an inspiration and role model.

Some of the themes can only be found under one or two categories of what makes a teacher. Hence the findings are divided into two sections. The first section is focusing on each theme across the different categories of what makes a teacher. As to the second section discussed the dominant themes found under what makes (i) a teacher, (ii) a good teacher, (iii) an excellent teacher and (iv) 21st century teacher. Table 1 below is a summary of the findings.

|                                 | A Teacher | A Good Teacher | An Excellent Teacher | A 21st Century Teacher |
|--------------------------------|-----------|----------------|----------------------|------------------------|
| Delivery of Necessary Content  | 14        | 6              | 5                    | 2                      |
| Awareness of Students’ Capabilities and Academic Achievement | 2 | 6 | 4 | 0 |
| Ability to Explain Concepts    | 2         | 5              | 1                    | 0                      |
| Pedagogical Versatility        | 0         | 5              | 11                   | 13                     |
| Memorisation                   | 3         | 0              | 0                    | 0                      |
| Effort and Commitment          | 0         | 3              | 7                    | 0                      |
| Sense of Responsibility for Future Generation | 1 | 1 | 9 | 12 |
| Becoming an Inspiration and Role Model | 1 | 0 | 6 | 0 |

3.1. First section

As can be seen from Table 1, the different themes based on the responses from the questionnaire will be elaborated further in this section. Furthermore, the frequency of the themes occurrence will also be described.
3.1.1. **Delivery of necessary content**
Responses that indicated the role of teachers was to deliver or transmit or transfer necessary knowledge in the context of syllabus were categorised as delivery of necessary content. 14 out of 20 science teachers mentioned the importance of having the ability to deliver subject content knowledge as part of being a teacher. 6 out of 20 science teachers reiterated this ability that makes a good teacher. As for what makes an excellent teacher, only 5 responses highlighted this theme again. While only 2 science teachers mentioned this ability for what makes a 21st century teacher.

3.1.2. **Awareness of students’ capabilities and academic achievement**
Responses that indicated teachers monitored their students’ development especially in terms of academic achievement were categorised as awareness of students’ capabilities and academic achievement. Only 2 respondents mentioned this trait for being a teacher. As for a good teacher, 6 respondents highlighted this trait. While only 4 respondents mentioned this trait for an excellent teacher and none for 21st century teacher.

3.1.3. **Ability to explain concepts**
Responses that indicated teachers that are able to explain concepts in a simplified way to ensure students understand were categorised under ability to explain concepts. There were only 2 science teachers mentioned the ability to explain concepts that makes a teacher and there were 5 science teachers highlighted this trait for a good teacher. As for an excellent teacher, only one science teachers reiterated this ability and no one mentioned this trait for what makes a 21st century teacher.

3.1.4. **Pedagogical versatility**
Responses that indicated the different ways of teaching such as encouraging collaboration among students or project based task or differentiated teaching were categorised as pedagogical versatility. 5 out of 20 science teachers mentioned about this ability for a good teacher. There were 11 and 13 science teachers who indicated this trait for an excellent and 21st century teacher respectively.

3.1.5. **Memorisation**
Responses that stated that the teacher only delivers content from textbook and encouraged students to memorise information were categorised as memorisation. There were only 3 respondents mentioned that a teacher required his or her students to memorise but none were available for the other categories.

3.1.6. **Effort and commitment**
Responses that stated teachers that extend their work hours outside of school hours in terms of preparation of teaching resources, lesson planning and taking care of students’ welfare and willingness to sacrifice time and money for the students’ benefit were categorised as effort and commitment. The respondents’ data demonstrated that only for a good teacher (3 respondents) and an excellent teacher (7 respondents) would put more effort into resource making and extend their work hours.

3.1.7. **Responsibility for future generation**
Responses that indicated that teachers who help in shaping students’ behaviour and mind set by equipping them with skills that applicable in the real world and instilling morale values were categorised as responsibility for future generation. Only one respondent mentioned about a teacher and a good teacher must feel responsible for the development of their students, not only in terms of academic but also life in general as they are the future generation of the country. While 9 respondents mentioned about this trait for an excellent teacher and 12 respondents for a 21st century teacher.

3.1.8. **Becoming an inspiration and role model**
Responses that indicated that teachers should inspire students and become a role model for the students were categorised as becoming an inspiration and role model. Only one respondent mentioned under what makes a teacher should be a role model and an inspiration to their students. While 6
respondents mentioned about this for an excellent teacher. While no respondent for both: a good teacher and a 21st century teacher.

3.2. Second section
As can be seen from Table 1, the dominant themes of the questionnaire under the different categories of teacher is discussed below.

3.2.1. What makes a teacher?
The dominant theme under this category was delivery of necessary content to the students. This demonstrated that the pre-service and in-service teachers put emphasis on the content knowledge for ‘a teacher’ category.

3.2.2. What makes a good teacher?
The dominant theme under this category was the ability to explain concepts to students. With comparison with the finding of 5.2.1, the pre-service and in-service teachers viewed ‘a good teacher’ as someone that is not only has a good content knowledge but also someone who has the ability to explain concepts to students.

3.2.3. What makes an excellent teacher?
The dominant themes under this category were teachers’ invested effort and commitment in teaching their students and be an inspiration and role model to their own students. In contrast to the first two categories, the pre-service and in-service teachers viewed ‘an excellent teacher’ as someone who is committed in their teaching and hold the responsibility of being a role model to the students.

3.2.4. What makes a 21st century teacher?
The dominant themes under this category were the teachers should have pedagogical versatility and have a sense of responsibility for future generation that went beyond the confinement of the classroom. As compared to the finding of the ‘excellent teacher’ category, the pre-service and in-service teachers had broaden the scope for ‘a 21st century teacher’ in that this type of teacher is not only as an inspiration to students in the classroom but to view these students as the country future generation. Furthermore, the finding also emphasised the importance of pedagogical skills in teaching.

4. Discussion
The finding leads to a general image of what constitutes and influences these teachers’ conception. Among them is their understanding of the importance of subject content knowledge and also the need to have pedagogical content knowledge. Theme on becoming inspiration and role model leads to these teachers’ awareness on the role of their identity as science teachers.

As stated in the second section of the finding, the responses from the pre-service and in-service science teachers indicated that a ‘teacher’ and a ‘good teacher’ are teachers who are able to deliver content to their students and be able to explain concepts to their students. This finding contradicts with the finding of another study done by Fajet, Bello, Leftwich, Mesler and Shaver [12]. In their study, they investigated traits of a good teacher and they found that the least mentioned theme was the subject content knowledge of the teacher. We stipulated that these particular traits of subject content knowledge and ability to explain concepts in our study might be closely linked to the nature of science itself. The subject matter is usually presented as a factual and theory laden body of knowledge. This can specifically be seen with the pre-service teachers where their exposure to science teaching was based on their experience in school and university level. Nonetheless, the in-service science teachers were also inclined to these themes for what makes a teacher and a good teacher. Thus the nature of science being presented might have some influence in their conceptions of a teacher and a good teacher.

In contrast to the science teachers’ responses to what makes ‘an excellent’ teacher and ‘a 21st century’ teacher, the focus shift more towards (i) social responsibility such as being a role model or an inspiration and shaping country’s future generation and (ii) pedagogical content knowledge. Taking
role model as related to identity, this concurs with the literature review discussed above on the relationship between teachers' identities and content knowledge in shaping their practices. The idea of being ‘an excellent’ teacher and ‘a 21st century’ teacher went beyond the limits of the classroom and school. In terms of pedagogical versatility, as a 21st century teacher, technology played an important role in the classroom. With the advancement of technology, it affords ‘a 21st century teacher’ to be more creative and innovative in their teaching so that students can be engaged during the lesson.

5. Conclusion
Several trends can be seen from our data analysis that are highly dependent on the different categories of ‘teacher’. Nature of science might played a major role in the response pattern observed among the pre-service and in-service science teacher in their conception of ‘a teacher’ and ‘a good teacher.’ As to ‘an excellent teacher’ and ‘a 21st century teacher’, social responsibility and pedagogical content knowledge played a major role in their responses.

As this study is an on-going research, it is hoped that the future data collection will be able to tap into more in-depth insights from these pre-service and in-service teachers. In turn, this in-depth data will provide better understanding on their developmental progress in becoming a teacher to 21st century teacher.

6. References
[1] Loughran J 2006 Developing a Pedagogy of Teacher Education: Understanding Teaching and Learning about Teaching. (New York: Routledge)
[2] Bryan, L 2012 Research on science teacher beliefs Second International Handbook of Science Education (Dordrecht: Springer)
[3] Bullough, R 1991 J. Teacher Ed 42 43
[4] Deemer S 2004 Educational Research 46 73
[5] Pajeres M 1992 Review of Educational Research 62 307
[6] Beauchamp C and Thomas L 2011 International J of Educational Research 50 6
[7] Ben-Peretz M 2011 Teaching and Teacher Education 27 3
[8] Clandinin D and Connelly F 1996 Educational Researcher 25 24
[9] Gess-Newsome J 1999 Secondary teachers’ knowledge and beliefs about subject matter and their impact on instruction Examining pedagogical content knowledge (The Netherlands: Kluwer Academics)
[10] Richardson V 1996 The role of attitudes and beliefs in learning to teach Handbook of research on teacher education (New York: Simon & Schuster Macmillan)
[11] Flores M and Day C 2006 Teaching and teacher 22 219
[12] Fajet W, Bello M, Leftwich A, Mesler J L and Shaver A N 2005 Teaching and Teacher Education 21 717