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Learning ‘New’ Instructional Strategies: Pedagogical Innovation, Teacher Professional Development, Understanding and Concerns

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Key words: teacher understanding, teacher concerns, teacher professional development, pedagogical innovation

Abstract

Teacher professional development (TPD) through supported pedagogical innovations relies on teacher understanding of what is proposed, how the innovation can be enacted, and ways in which an innovation might be effectively adapted to local conditions. This article describes evolving teacher understanding during a one-year reading comprehension innovation.

Analysis, based on a two-dimensional neo-Bloomian framework, revealed that types of teacher understanding aligned with specific strategies used at specific times in the innovation programme to some extent. Initial concerns about cultural appropriateness tended to fade as participating teachers came to their own understandings of how to employ the new instructional strategies. Other teacher concerns shifted from hypothetical to more concrete concerns about how to further enhance classroom interactions, evidencing evolving teacher understanding. Importantly, while examining in-class practices shows only the outcome of an innovation, tracking teachers’ developing understanding was important for gaining insights into the on-going TPD process.

Introduction

Teachers and teacher professional development are fundamental to any effective educational innovation effort (Desimone, 2009; Darling-Hammond, 2017; Fullan, 2007). Even when school systems are successful, there are constant efforts to improve. We examine the case of

one teacher professional development (TPD) effort undertaken at one school in an educational system which is considered to be highly successful. Though the nation, Singapore, consistently ranks at or near the top in assessments such as PISA (OECD 2017) and PIRLS (Mullis et al. 2017), the school we worked with found that their students were weak in reading and hoped that innovations in teaching would lead to improvement. The Singaporean educational system is highly centralised with national syllabi for each subject set by the Ministry of Education (MOE) and national examinations at critical educational junctures (e.g., the end of primary school). For English Language (EL) at primary grade levels, there is also a national curriculum known as STELLAR (CPDD, 2008-2016) which is optional in principle but which has been taken up wholly or in part by most primary schools.

Our research team engaged in a collaborative, multi-year, professional development project focussed on reading instruction. Based on our initial observations as well as our knowledge of local education policies, we focussed on teacher-led discussion in reading comprehension lessons. In making this choice, we factored in features of the local educational culture such as the importance of teacher control and authority and the prevalence of teacher-led discussion (Curdt-Christiansen and Silver, 2012), as well as teachers' perceptions that their role is to teach the curriculum (rather than, for example, seeing themselves as change agents who shape the curriculum) (cf. van der Heijden, Geldens, Beijaard & Popeijus, 2015).

Deep teacher learning can result when collaboration, an enabling school culture, and pedagogical innovation mesh (Hennessy, Mercer & Warwick, 2011; Kraft & Papay, 2014; Lefstein, 2008), and when TPD is effectively supported and facilitated (e.g., Borko, Elliott & Uchiyama, 2002; González, Deal & Skultety, 2016). However, it is well known that teachers might make sense of pedagogical innovations differently than the originators of the innovation intended (e.g., Cohen, 1990; Spillane, Reiser, & Reimer, 2002). In addition,

changes in classroom practices take time to develop (Garet, Porter, Desimone, Birman & Yoon, 2001). How could we gauge and engage teachers' evolving 'sense-making' of the innovation?

Bakkenes, Vermunt, and Wubbles point out that "meaning-oriented learning (e.g., trying to extend one's *understanding* of own practice and of new ideas, trying new practices based on that *understanding*) is an important aspect of teacher and student learning" (2010, 546, emphasis ours). Examining in-class practices would show only the outcome of the innovation without opportunities for engaging with teachers in a more process-oriented way. We felt that tracking teacher understanding could provide a window into the process of learning. In this article, we discuss our efforts to understand the evolving understandings of participating teachers and how those efforts shed light on the TPD process.

Teacher Professional Development and Teacher Understanding

Teachers' practices and beliefs (e.g., Burke, 2013; de Vries, Wim, van de Grift & Janson, 2014) as well as the sequence of development in these practices and beliefs (Clark & Hollingsworth, 2002) have been extensively studied. While some models have emphasized stages of development (e.g., Nolder, 1992; Katz, n.d.) Dell'Alba and Sandberg (2006, p. 388) specifically critique stage models by arguing that "a fundamental dimension of professional skill development – namely, *understanding of, and in, practice* – is overlooked." With this in mind, we focus on teacher understanding as a central part of the TPD process and offer one possible way to examine evolving teacher understanding as part of the innovation process. using a two-dimensional, neo-Bloomian taxonomy developed by Anderson, et al (2001).

In this revised version of Bloom's original taxonomy there is a Cognitive Process Dimension (a continuum of cognitive complexity with six categories, e.g., 'Remember', 'Apply', 'Evaluate') which intersects with a Knowledge Dimension (a continuum of four

categories moving from more concrete to more abstract types of knowledge, e.g., ‘Factual’, ‘Metacognitive’), forming a 24-cell matrix (Anderson, et al, 2001). The revised taxonomy has a few changes in terminology (e.g., ‘Understand’ rather than ‘Comprehension’ and ‘Create’ rather than ‘Synthesis’). Some of the original categories have been reordered and a Metacognitive Knowledge category has been added (Krathwohl, 2002). Using the revised taxonomy, we hoped to examine evolving changes in the way teachers understood specific instructional strategies as well as broader conceptions of reading comprehension and classroom interaction.

Teacher Concerns & ‘New’ Instructional Strategies

While our primary focus was on teacher understanding, a sub-theme was teacher concerns about ‘new’ instructional strategies: instructional strategies which were based on educational principles from other countries and were well-known elsewhere, but which were new to these teachers. As explained below, a key part of the innovation was to implement Questioning the Author (Beck & McKeown, 2002), a reading comprehension instructional strategy developed in USA, and Negotiation for Meaning, a discussion strategy to deal with misunderstandings in second language communication (Pica, 1994; Van den Branden, 2000). Implementation of these strategies would require a substantially different interactional style from what the teachers were used to and one which the teachers might feel was inappropriate for the Singaporean school culture.

Other scholars have surfaced issues with educational innovations imported from the ‘West’ to the ‘East’ (e.g., in Vietnam [Pham & Renshaw, 2015], China, [Hu & Webb, 2009], Hong Kong [Lai, Li & Gong, 2016]). Thus, adopting and adapting new instructional strategies, especially ones perceived to be from a different educational and cultural context, can raise concerns for teachers. Culture and values can sometimes clash with curriculum

reforms, resulting in surface level compliance without deeper pedagogical change (Curd-Christiansen and Silver, 2012). Conversely, innovation activities in EL at primary grade levels in Singapore have often included new instructional strategies which originated in Western educational systems to develop literacy, communication and thinking skills (CPDD, 2009).

Research Questions

With this background in mind, we were interested in tracking teacher understanding and concerns in an on-going manner. Guiding research questions were:

1. What are the teacher understandings evidenced during participation in the instructional innovation, and in what ways does teacher understanding of the new instructional strategies change throughout the year?
2. What are the concerns expressed by teachers with regard to the innovation and in what ways do these concerns change throughout the year?

Local Context

Data were taken from the first year of a multi-year professional development project at one Singaporean primary school. The school was mixed-gender drawing students primarily from nearby homes. Students and teachers were mainly Singaporean, comprised of the ethnicities common to Singapore: Chinese, Malay, and Indian. Home languages in Singapore include Mandarin, Malay, Tamil and English which are also the official languages. English is increasingly used at home but use of other languages at home is still common (Department of Statistics, 2011). Multilingualism at home is more common than is monolingualism with some indications that younger Singaporeans favor English (Vaish, Jamaludeen, Roslan, 2009). Literacy rates are high with 95.9% of the population over age 15 literate in at least one language, 79.9% of those reported literacy in English and 70.5% in two

or more languages (Department of Statistics, 2011). Multilingualism is supported by an educational system that uses English as the main medium-of-instruction but requires study of EL plus one ‘Mother Tongue’ (Mandarin, Malay or Tamil) from primary through secondary school. (See Silver & Bokhorst-Heng, 2016 for an overview of the language education system.)

Based on parent surveys, school leaders reported that many students spoke a language other than English at home; details were not shared with the research team. Based on national assessments, the school was considered to be academically mid-range. Though Singapore does well overall in international reading assessments, the Principal and English Language Head of Department (HOD) felt the students needed to improve in this area. Thus they were eager to have teachers engage in a professional development project related to reading comprehension. The school followed the national EL syllabus (CPDD, 2001) and was using the national EL curriculum known as STELLAR (CPDD, 2008-2016).

Methodology

Data were taken from the first year of a multi-year TPD project in one mixed-gender, Singaporean primary school which drew students primarily from nearby housing estates. All teachers and most students were Singaporean with a mix of ethnicities common to Singapore (Chinese, Malay, Indian). The school followed the national syllabus and used the national EL curriculum. Academically, the school was considered to be mid-range based on national assessments. The Principal and the EL Head of Department (HOD) were eager to have the school engage in a TPD project related to reading comprehension. All EL teachers in the school were invited to participate. Six teachers volunteered – two each at primary grades 3, 4, and 5 – and committed to work the full year with a university-based research team to change the way reading comprehension discussions were led in their classes.

Overview

The innovation was comprised of a school-based TPD project with collaboration between the university-based research team (university-based scholars and teacher trainers) and the participating teachers. Brief background information for each teacher was collected (Table 1). Some background information on the teachers' conceptions of reading comprehension was also gathered via a short, open-ended questionnaire (e.g., "What is the role of the author in facilitating comprehension by readers?" "What is the role of the teacher in reading instruction?"). An interview in which each teacher talked about reasons for joining the project, views on teaching reading comprehension, and knowledge of the two instructional strategies which would be introduced was conducted, audio-recorded and transcribed. The purpose of the questionnaire and interview was to provide a starting point for discussion with the teachers during our team meetings, thus details from those instruments are not reported here.

Throughout the year, the research team and teachers met regularly, forming an 'innovation team'. Meetings were scheduled weekly (20 in all) with the exception of holidays, term breaks, and exam periods. Early in the year, meetings focussed on learning about the new instructional strategies through reading, discussion, and watching videos of lessons in which the strategies were used. We refer to this as the *Direct Instruction (DI)* stage. Later in the year, innovation team meetings focussed on co-planning of lessons, role plays to prepare the teachers for teaching the lessons, and discussion of lesson videos after the teachers had tried the strategies with their own students. We refer to this as the *Practice Stage (PS)*. (See Silver & Png, 2016.)

Four lesson observations per teacher were conducted with audio and video recording. These included two baseline lessons during the DI – an EL lesson of the teacher's choice

(e.g., focussed on reading, writing, vocabulary) and a ‘reading lesson’ in which the teacher used her¹ usual strategies for teaching reading comprehension. During the PS, teachers taught two co-planned reading lessons in which they implemented the new instructional strategies. Lessons were transcribed; the transcripts and videos were shared with the teachers.

One-on-one post observation conversations (POCs) including watching and discussing the video recorded lesson together were conducted. The primary purposes of the POCs were to encourage reflection, provide feedback, and ascertain developing teacher understanding (Kim & Silver, 2016b). These conversations were also audio and video recorded, then transcribed. Teachers also completed three written reflections — beginning, middle and end of the year— addressing, for example, what teachers felt they had learned so far, which activities were most useful, and how this might change their future teaching. Table 2 provides an overview of the timeline and research activities.

TABLE 2 ABOUT HERE

Instructional Strategies

As above, two teacher-led, whole-class discussion strategies were fundamental to the project: Questioning the Author (Beck & McKeown, 2002) and Negotiation for Meaning (Pica, 1994; Van den Branden, 2000). The innovation aimed to encourage the teachers to adopt and adapt these strategies for their EL teaching.

Questioning the Author

Questioning the Author (QtA) is well-known in the United States but was little-known in Singapore at the beginning of this study. QtA encourages questioning while reading,

¹ All teachers are referred to as ‘her’ in order to maintain anonymity of participants

requires students to speak and listen to one another as they negotiate the meaning of a text, and promotes critical thinking (Beck & McKeown, 2002; Beck, McKeown, Sandora, Kucan, & Worthy, 1996). QtA was chosen because teacher-led discussion in QtA is intended to encourage students to discuss, think about, interpret, and question a text — which aligns with goals of the national syllabus. Also, as a teacher-led discussion strategy, QtA would offer some comfort to teachers who were used to teacher-centred strategies. Finally, QtA is a classroom-tested instructional strategy which has been used successfully with at risk readers (Beck, et al., 1996). This would address concerns that some of the students were weak readers or came from homes where English was not the dominant language.

Negotiation for Meaning

Teachers were also introduced to Negotiation for Meaning (NfM) – a concept from second language acquisition research which suggests that comprehension is achieved through interlocutors working interactively to repair misunderstanding or possible misunderstanding (e.g., Pica, 1994). Van den Branden (2000) successfully used NfM as part of teacher-led discussion to support reading comprehension with both first and second language children. His research suggested that teacher-led NfM was particularly facilitative of comprehension. Using NfM, the teachers could address comprehension issues during discussion, especially those relating to vocabulary.

Data Analysis

Analysis was based on 15 transcripts of innovation team meetings², 24 POC transcripts and 18 teacher written reflections (3 per teacher). Data were analysed qualitatively

² Transcripts of the role play sessions were not included as they were comprised of the teachers leading a demonstration lesson and receiving feedback from the research team rather than the teachers commenting and reflecting on their own understanding and concerns. In addition, lesson planning sessions 2 and 3, and two sessions in which teachers revised their lesson plans were not included due to poor audio quality.

for evidence of and changes in teacher understanding (TU) and concerns (TC) during each stage (DI and PS). The framework for analysis of TU was drawn from Anderson et al. (2006), a neo-Bloomian taxonomy comprised of a Cognitive Process Dimension with six categories along the horizontal axis and a Knowledge Dimension with four categories along the vertical axis

Similar to the original Bloom's Taxonomy, the revised taxonomy can be used to set learning objectives with varying cognitive requirements. However, rather than setting learning objectives of what understanding should be, we used the revised taxonomy (hereafter 'the taxonomy') to gauge the type of knowledge (Factual, Conceptual, Procedural, Metacognitive) and cognitive process (Remember, Understand, Apply, Analyse, Evaluate, Create) evidenced by the teachers over time. Crucially, the taxonomy allowed us to consider developing understanding on intersecting continua of Cognitive Processes and Knowledge rather than categorizing understanding as stable or binary (yes/no). In addition, the revised taxonomy includes a category for metacognitive knowledge which helped us consider the teachers' awareness of their own understanding. (See Pintrich, 2002.)

The taxonomy is meant to be flexible with adaptation for different types of content learning. This allowed us to make the analysis specific to our innovation programme by considering reading comprehension and the instructional strategies of QtA and NfM as the 'content' of teacher learning. For example, on the Knowledge Dimension, 'Factual knowledge' has to do with discrete, isolated content elements (e.g., for children this might include the name of the author of a storybook). Adapted for our study, this included teacher knowledge of terminology, details, and basic facts about QtA, NfM and reading comprehension. 'Conceptual knowledge' refers to interrelationship of basic elements (Anderson, et al, 2001). Adapted for our analysis, this included understanding of main concepts, principles and structure of QtA, NfM, and reading comprehension; knowing how

they are organized, implemented and differentiated from other strategies. On the Cognitive Process Dimension, 'Remember' has to do with identifying, retrieving, recalling or recognizing relevant knowledge, events, procedures, etc. For our analysis, this referred to 'remembering' as related to QtA, NfM and/or reading comprehension. When used as a matrix in our study, evidence of TU was coded as Factual:Remember when, for example, terminology and basic facts about QtA were retrieved. When information about main concepts and principles of QtA were retrieved or recalled, on the other hand, this was coded as Conceptual:Remember. These distinctions helped us to investigate TU in a fine-grained manner as well as tracking changes over time. (See Appendix A for descriptors.)

For the analysis of TU, the data set was independently coded by two coders (2nd and 3rd authors of this article). Inter-coder agreement was established with a sub-set of POC transcripts and teacher reflections. Based on an agreement of $k = .75$ or higher for each category in the taxonomy, agreement was determined to be sufficient. The remaining data were split between the two coders for individual coding. The coding was also reviewed regularly by the Principal Investigator (1st author), in discussion with the two coders. After all data were coded, patterns for TU were compared within and across the DI and PS. This analysis revealed when different types of understanding emerged and which types of understanding were most frequently evidenced at different stages of the innovation.

TC initially arose in an ad hoc fashion as we considered concerns that should be addressed during innovation team meetings. However, as the project continued, we began to see patterns in the TCs and suspected these linked to TU. We decided to investigate teacher concerns more rigorously using thematic analysis (Braun & Clark, 2006). Our process was inductive, based on first identifying segments of data in which teachers expressed some type of concern related to the innovation, then generating descriptive codes to highlight the topic of each concern (Saldana, 2013, pp. 87-91). Specifically, one member of the research team

(3rd author on this paper) familiarized herself with the data and drafted initial, descriptive codes. The initial codes were discussed extensively with the research team using examples of coded data and full transcripts to establish patterns in the types of concerns and to draft relevant descriptors. These ‘pattern codes’ were then used by the 3rd author to re-examine the entire data set and re-code as needed. The pattern codes were then discussed in detail with the Principal Investigator, again with reference to examples of coded excerpts and entire transcripts. Tables were drawn up showing most common concerns during DI but not PS and vice versa, concerns referred to by all teachers (regardless of how frequently) or concerns frequently mentioned by more than one teacher. All data were reviewed by the 1st and 3rd authors to consider how well the codes represented the most common TCs in the DI and/or PS. Coding was checked a final time by the 3rd author by re-reading all transcripts and by the 1st author using the ‘query’ function in QSR International's NVivo 10 software to sort the data by teacher, by stage of innovation, and by code. Through this process of iterative reading, coding, sorting and discussion, two overarching areas of concern were established: ‘teacher concerns about students’ and ‘teacher concerns about their ability and the implementation’.

Findings

Teacher Understanding

Analysis revealed that TU of the strategies and concepts introduced (QtA, NfM and reading comprehension) emerged along both continua throughout the year. Teachers not only gained knowledge about new facts, concepts and procedures but also became more analytical and evaluative about the strategies and their own practices. Table 3 provides details of the types of understanding evidenced during each stage. Below, we briefly describe the types of understandings shown during the DI and PS in relation to the types of activities undertaken as

part of the TPD. We then summarize the changes across the year. Excerpts are included throughout to illustrate the relevant categories of the taxonomy. In all cases, excerpts were chosen because they were deemed by the authors to best represent the category (e.g., Remember, Analyse, Procedural, Metacognitive) under discussion.³ The categories are also reflected in our discussion of each excerpt, for example, when we refer to the teachers ‘remembering’, ‘analysing’, etc.

TABLE 3 ABOUT HERE

Teacher Understanding during the DI stage

During the DI stage, innovation team meetings gave the teachers an opportunity to grasp new ideas and ask questions as well as raise doubts or clear misunderstandings. These were reflected in teacher comments about their own emerging understandings. There was a high number of comments related to remembering material discussed and facts about QtA (Remember:Factual), evidence of teachers’ ability to comprehend and grasp the facts and materials by giving interpretations, explanations or summaries (Understand:Factual), as well as interpreting, inferring or explaining the procedures of the new instructional strategies (Understand:Procedural). There was also considerable evidence of teachers understanding the possibilities for how they might carry out the new strategies (Apply:Procedural).

For example, in Excerpt 1 the teachers were discussing with a member of the research team who was acting as a discussion leader (DL). ‘They’ in turn 1 refers to the authors of an article the group had read (McKeown, Beck & Worthy, 1993). In turn 3,

³ More specifically, all excerpts were chosen by querying each code (e.g., Apply/Procedural), re-reading each coded excerpt, and selecting an excerpt which seemed to a) best exemplify the code and b) could be explained within the context of this article (e.g., did not rely too heavily on local knowledge or implications beyond the excerpt). Excerpts were checked by all three authors, discussed, and final selection was made by the 1st author based on an assessment that the excerpt was a clear representation of the specific code.

Teacher Alice refers to ‘them’ – students who might be demoralized by not understanding classroom texts. The idea that students, especially weak readers, would place all blame for lack of comprehension on themselves (instead of, for example, the structure of the text as created by the author) was a key idea presented in the article the teachers were discussing. In turn 5, Teacher Alice explains, showing her emerging grasp of facts about QtA and reading comprehension.

Excerpt 1⁴

1 Alice DL I think they [the authors] are trying to show the negative impact of the
(pause) the inability to understand the textbook. The negative impact
on students.

2 DL Alice What is that negative impact?

3 Alice DL Like uh it cause them [the students] to be rather demoralized.

4 DL Alice Uh huh.

(Alice goes on to recap an idea from the reading: that students ‘blame themselves’)

5 Alice DL Then and, instead of uh, facing uh or trying to solve their problems of
not being able to understand what they’re reading, they, they sort of
like blame themselves that, oh, ok, ah, you know they have this
difficulty ok, of trying to face it.

(InnovationTeamMtg_P3-4_26.01.11)

Excerpt 1 illustrates the type of comments teachers made during the DI stage, providing evidence that the teachers were explaining, interpreting, exemplifying what they had learned (Cognitive Dimension: Understand) by recapping discrete bits of information (Knowledge Dimension: Factual) from the articles and practice lessons.

⁴ Transcripts show some variation in grammatical forms used. These should not be taken as indicators of the low English proficiency but simply as a function of spontaneous speech.

Teacher Understanding during the PS

During the PS, Procedural knowledge (discussions of how to plan and carry out the procedures for the new instructional strategies) at most cognitive levels and especially at the level of Apply (2919 comments) was prominent. There were also numerous comments evidencing teacher Metacognitive knowledge (563 across different cognitive processes) indicating increasing understanding, awareness and analysis of their teaching practices and techniques.

Excerpt 2 is from the PS. Teachers Bee and Grace were co-planning a lesson, with some comments from a member of the research team (RT). The teachers focused on factual information (the location of San Francisco) in a reading they planned to use. Teacher Bee initiated the discussion, “But the thing is that even though this whole story ah, and I think this whole story although it’s based on Japan, the pupils might be confused in the sense that there’s brief mention of San Francisco, California and Chile.”

Excerpt 2

- 1 RT Bee Is not quite well linked right?
- 2 Bee RT Ah, probably if they say, ah San Francisco, USA.
- 3 Grace Bee In USA.
- 4 Bee RT In USA, so at least...because right now, they just mentioned that this building in San Francisco.
- 5 RT Bee Uh huh.
- 6 Bee RT So they don’t have the prior knowledge that ah where is San Francisco, they might just have this wrong idea, ok, that this San Francisco is actually in Japan itself.
- 7 Grace Bee Hmm...

8 RT Bee Right, right, right. Anything else?

9 Bee RT But other than that as I said uhm... it's very picture rich and really you can really see what is the destruction, the mess happening. Ah... representation of the whole situation there can be really, be visually seen in that sense. So you can actually...to me ahh you can imagine yourself to be there at that point of time.

(LessonPlanning1_P3-4_23.03.11)

In Excerpt 1, taken from the DI stage, Teacher Alice was merely recapping factual information from an article the group had read. Similarly, in Excerpt 2 (during the PS) the teachers began by demonstrating understanding of factual information (turns 1-6). However, in Excerpt 2, the teachers also considered the visual information (a picture of the aftermath of an earthquake in Japan) which accompanied the print. In turn 9, Teacher Bee's comment evidences the Cognitive Process of Evaluate (critiquing the presentation of information and considering appropriateness) with implications for the Knowledge Dimension of Procedural (how to carry out the lesson procedures) which was much more evident in the PS (116 comments) than the DI (50 comments).

During the PS, the teachers also became more aware of how they conducted their lessons with reference to QtA principles and techniques as can be seen in the increase in Metacognitive:Apply (Table 3). For example, QtA discussion should be interactive with a less tightly teacher-controlled discussion. As the teachers tried to encourage more interactive discussions following QtA principles and techniques, they also became more aware of student behaviour and how that was related to their applications of new knowledge. This is evident in Excerpt 3, when Teacher Ann, shows awareness of how her ideas about discussion and her students' behaviour had changed. While she had previously felt that discussions of the reading were noisy, with students potentially off-track, she came to realize that noise

could be generated by fruitful discussion of the text. In Excerpt 2, she expressed awareness of having had a misconception and of changing her practice (indicating metacognition) in relation to how she enacted whole-class discussion.

Excerpt 3

But there was one interesting thing I learnt about my class when I watched this video. I used to think that when we have discussions, right, they are noisy just because they are noisy and talking about other things. But when I look at what they are doing or what they are saying, right, it's like they are actually responding to the text. Even though they are responding amongst their small groups, right, which contributes to the noise, but they are discussing about it. Which is a misconception on my part for quite some time. Yeah.

(Interview 3_An_12.08.11)

Changes across the year (DI – PS)

From Table 3 and the illustrative excerpts, we see that TU developed from remembering factual information about the new instructional strategies to greater understanding and awareness of their own teaching practices, their student responses, how they could implement the strategies, and the potential for improving reading comprehension through discussion.

We also see increasing evidence of Procedural and Metacognitive knowledge across almost all cognitive processes, with the exception of Create. Comments reflecting Procedural knowledge carried across the Cognitive Process Dimension as the teachers not only remembered and understood how to do QtA/NfM, but considered how best to apply the strategies, with increasingly analytical and evaluative understanding. For example, during one POC Teacher Carol evaluated her own use of QtA and what she was still finding to be a challenge:

Yeah, so I find that getting [the] full class to be engaged with me using this QtA is actually a challenge. Hmm, it's a challenge. It's more difficult to monitor. Hmm. But okay let's say I call on Yong Huei. He may give me a response. Then after that when he sits down, okay, he may not be with me already; then again he will drift off. I find that it's still very much like [the] monitoring part is quite tough.

(Interview3_Ca_20.07.11)

The teachers also demonstrated more awareness, as compared with the DI stage, of what they knew and what they were able to do on their own, how they were benefitting from the innovation and how the new instructional strategies might influence student progress (Metacognitive knowledge). We see this in Alice's end-of-year written reflection:

I've learnt to practice more patience in class especially [as] it encourages the lower progress pupils to respond to the discussions. The classroom discussions are more 'open' and pupils are given more opportunity to explain and rephrase each other's responses. In our lessons, I've made it quite clear that the author is fallible and thus pupils with more confidence participate in the discussions. At different points I am able to assess pupils' understandings and re-emphasize them rather than wait until the end of the lessons.

(Reflection3_A1_25.11.11)

These developments were in alignment with the types of activities used during the two stages of the innovation. At the DI stage, teachers were offered information about the new instructional strategies; their main task was to try to remember and understand. During the PS, the teachers were tasked with not only remembering and understanding the procedures but also applying the strategies, thinking about possible adaptations for a specific group of students, and reflecting on their own implementation, showing evidence of the Cognitive Processes of Apply, Analyse and Evaluate.

Finally, despite greater evidence of understanding across the year in almost all categories of the taxonomy, there was no evidence for TU in the area of Create. This was understandable in the DI stage when the teachers were following lessons plans provided to them. However, even in the PS, when the teachers created their own lessons, their comments suggested attempts to follow what they had been taught, rather than thinking of themselves as potential ‘creators’.

Teacher Concerns (TC)

Despite increasing understanding as seen in both the Knowledge and Cognitive Process Dimensions, the teachers also saw the implementation of the new instructional strategies as challenging and expressed concerns regarding various aspects of the innovation. These concerns fell mainly into two broad areas: concerns about students and concerns about themselves as teachers (Table 4).

TABLE 4 ABOUT HERE

At the DI stage, when the teachers were introduced to QtA/NfM but were not yet applying the strategies in their lessons and didn’t know how the students would respond, they were more concerned about possible issues for students, in particular, the possible impact of QtA on student-readers and the possible impact of students’ academic abilities on discussion. Their comments reflected underlying concerns about the appropriateness of the instructional strategies for the local context in which students were expected to be able to answer designated questions ‘correctly’ and students were regularly ‘streamed’ into ability groupings.

However, these concerns about students tended to diminish later in the year. During the PS, concerns centred more on how they, as teachers, could effectively implement the strategies in terms of classroom management and interaction, student comprehension and learning, and technical expertise. Figure 1 shows the frequency in types of TC expressed by the number of teachers who commented on each topic at each stage (i.e., how many teachers showed concern about this topic).

FIGURE 1 ABOUT HERE

Overall, concerns about students decreased from DI to PS as the teachers found that selecting materials, student academic ability, and the ability to ask questions were not serious impediments to carrying out the instructional strategies nor to classroom management. Most notable was the change in teachers' initial concerns that students would not be willing or able to answer questions in whole class discussions: 15% of the concerns expressed during the DI, with 5 of the 6 teachers commenting, were about this, but only 5% of the comments in the PS, with 4 of the 6 teachers commenting, related to this topic. Also, despite research showing that QtA and NfM could be used effectively with lower level readers (Beck et al., 1996; Van den Branden, 2000), during the DI participating teachers had felt that a more structured approach might be needed to support students (Excerpt 4).

Excerpt 4

Are the children capable enough later on to tackle questions on their own or will there be another session? Say let's, say the QtA is not effective, will there be like another comprehension lesson, ...?

(TeacherInterview1_A1_24.02.11)

Comments on students being able to answer questions during class discussion were often linked to concerns for student academic ability and knowledge. These also related to issues of the local culture such as familiarity with more structured lessons and unwillingness to speak up in class. This was evident in Teacher Bee's comments during the DI stage (Excerpt 5).

Excerpt 5

But um you realize that a lot of them, once you ask a question, they will be dumbfounded. They won't know what to answer you. Like yesterday, right, you know, once you ask them "What does it mean by that (unclear)?" a lot of them, they will be stuck there. Yeah. So this is, I feel lah, [the] initial part will always have this problem where by it will just be a one-way traffic first, until they are accustomed to it, the way that you ask them. Then, hmm, okay, slowly. But as I have said, once I believe the pupils are geared or their mindset has been shifted to this type of thinking, I will find that this will be very interactive lessons.

(Interview2_Be_21.04.11)

Although concerns about student ability and possible negative impact on students decreased during the PS, TCs about how to check student comprehension, help students understand the text, use questioning techniques effectively and increase classroom interaction grew. Teachers were concerned about their own ability to check student understanding (i.e., student reading comprehension). This went hand-in-hand with recognizing the importance of their own questioning techniques as they explored student understanding. As illustrated in Excerpt 6, extracted from the first POC carried out in the DI stage, the teachers realized that their questions had to push students further in their thinking.

Excerpt 6

Hmm, I used to think that if they were able to answer my questions that they understand, but I think now it's more than that. It's erm actually to probe them to think, erm more than just the surface. 'Cos sometimes the questions that we asked, very surface questions, and then the moment they give us that answers we are like "ok yes, they understand". It doesn't mean that.

(Interview1_An_24.02.11)

At the end of the school year (during the PS), the same teacher reflected:

Excerpt 7

I have given more freedom to my pupils to lead discussions and talk more. Instead of trying to "feed" them answers, I have forced them to construct their own understanding through discussion. I have also moved away from finding out about what the pupils don't know, but now towards what do my pupils know and how they can share this info with the rest of the class. I think it has also made lessons interesting for me and my pupils, as they get to interact with me more than just answering my questions. It has also made lessons less threatening because it seems like I accept anything the pupil says rather than just answering correctly.

(Reflection 3_An_11.11.11)

Excerpt 7 indicates a perceived change in the classroom discourse, allowing more student talk and more freedom for students to lead the discussion, which led to greater student engagement. The teacher also shifted her focus from what her students didn't know to their contributions in classroom discussion, thus making the lessons less threatening and more interesting for the students. Of particular note is that her initial concern about leading discussion (during the DI) is reframed during the PS to show developing TU.

One concern expressed by the teachers throughout the year was how to manage the class and move lessons forward while engaging in open-ended discussions (see Figure 1, “Controlling Classroom Interaction”). With the flow of student responses, teachers were not always able to follow their detailed plans; instead they had to manage discussions ‘on the fly’. This concern is illustrated in Excerpt 8, taken from a POC with Teacher Alice during the DI stage.

Excerpt 8

My main concern is, like, I might be afraid that I might lost focus and then, eh, what actually was I supposed to talk about, you know? Because there was so many responses ... Because sometimes what we plan may not turn out to be. Like certain responses, we thought “Oh the pupils can do”. But actually no, we are not really prepared in the plan [for unexpected responses].

(Interview3_AI_12.08.11)

While these concerns continued during the PS, they were outweighed by teacher perceptions of the benefits of the instructional strategies, QtA in particular. Students were more involved and responsive when teachers were more flexible and less focused on their pre-planned questions.

In sum, even though the teachers expressed a number of concerns, overall they became less sceptical and more favourable towards use of the new strategies in the local context. They were also more confident that the new strategies could be applied in their classrooms, regardless of student ability. Prior to using the new strategies, most of the teachers believed that this type of discussion was only suitable for ‘high ability’ students as those students were generally more responsive and more able to contribute to classroom discussions. After teaching the lessons, the teachers found that their students at different ability levels could cope.

Discussion

Examining Teacher Understanding

In the neo-Bloomian framework we used to examine teacher understanding, the dimensions of Knowledge and Cognitive Process are described as continua (Anderson, et al., 2006). The Cognitive Process Dimension is a continuum of progressively more complex cognitive processes; the Knowledge Dimension is a continuum from more concrete to more abstract. Crucially, the Cognitive Process Dimension is not considered to be a cumulative hierarchy. The revised taxonomy recognizes greater cognitive complexity in the different categories but not necessarily cumulation. This is reflected in our data: The teachers showed understanding at most levels of cognitive processing throughout the study, though they were more likely to comment on remembering and understanding in the DI and more likely to comment on application, analysis and evaluation in the PS. Along the Knowledge Dimension, the teachers showed a greater awareness of their own learning and the concepts developed through the instructional innovation, with increasing metacognition as the study progressed. Overall, moving from the DI and PS we not only saw evidence of understanding in ways that were more cognitively complex but also knowledge that was more abstract.

Understanding Innovations

Our findings suggest that one issue in attempting to encourage instructional innovation is the development of teacher understanding. Prior research (e.g., Cohen, 1990; Lefstein, 2008; Spillane, Reiser, & Reimer, 2002) has considered teacher understanding as having a possible positive/negative effect on innovation. However, we sought to identify types of teacher understanding and to track how those understandings changed overtime. We feel this is an

important addition to investigations of TPD which emphasize outcomes rather than processes of development.

We also found that different types of understanding do emerge at different stages of the innovation, and we suggest these are linked to the types of activities in which the teachers engage. For example, during the DI stage, teachers were offered information about the new instructional strategies, their purposes and procedures. Their main task was to try to remember and understand. While there was some attempt to consider applications of the new strategies, these were mostly aimed at developing understanding of recommended procedures (Procedural knowledge) – rather than analysing elements of the strategy or deconstructing procedures to understand how they fit together at a more conceptual level. During the PS, the teachers were tasked with not only understanding QtA procedures but also demonstrating applications of the strategy, thinking about possible adaptations for a specific group of students, and reflecting on their own implementation. This required greater analysis (i.e., examining parts or components of the strategies, seeing how different elements could be organized or fit together) and evaluation (i.e., critiquing, detecting inconsistencies, and considering appropriateness). Overall, teacher understanding developed in alignment with what was being taught and how it was being taught at each stage.

We see this alignment in the teacher concerns as well. The DI stage focused on teachers learning the basics of the new strategies, leaving open the question of student response. At this stage, the teachers were most concerned with that unanswered question. How would the students respond? Would they be able to participate in the type of discussions which the new strategies were intended to encourage? Before teachers had implemented the new strategies in their classrooms, they consistently envisioned that student responses would be limited, in ways that were similar to what the teachers saw in their pre-innovation practice. As they moved into the PS and enacted the new strategies, the teachers found less reason to

be concerned about student responses. During the PS, teachers expressed fewer concerns about *whether* the strategies could be used effectively and more concerns about *how* the strategies could be implemented more effectively. As teachers moved from the DI and through the PS, their concerns also reflected a greater awareness of the complexity of classroom interactions. Referring back to Excerpt 6, we saw that the teacher's comment implied a rather simple cause-effect relationship between the questions she asked and student understanding. Near the end of the year, the same teacher saw student contributions in light of constructing understanding, sharing information, student engagement and interaction (Excerpt 7). She thought more about what students could bring to the classroom conversation. Thus we view examination of teacher concerns as an additional facet of teacher understanding.

Cultural Appropriateness

While teachers did initially worry about whether their students could manage with these 'new' strategies – fearing their students wouldn't speak up due to cultural constraints and possibly would not learn what they needed for high-stakes, local assessments – as the teachers moved into the PS, these fears faded. Cultural appropriateness and possible incompatibilities with 'imported' instructional strategies were no longer issues. In the context of this study, the teachers confronted their own ideas about what might be possible in terms of applying the new strategies in their reading lessons (cf. Hepple, 2012; Lai, Li & Gong, 2016; Montgomery, 2014). Examination of teacher understanding showed that the teachers came to see the innovation not as a set of borrowed strategies, but as strategies they could embed in their own practice. However, in one area there was no change: there was no evidence in this one-year study that the teachers saw themselves as change agents who were creating new resources and generating new knowledge (for themselves and their students).

Though the teachers developed new lessons plans with children's literature they selected and with their own specific classes in mind, they did not see themselves as 'creating' lessons, but as following the model presented in the innovation programme. This suggests that they continued to perceive their role as teaching the curriculum, rather than creating or shaping it – a role they felt was compatible with local expectations.

Local, school culture can be an important consideration in TPD. For example, Kraft and Papay (2014) found that particularly supportive professional environment in one urban area in the US influenced the extent to which teachers continued to improve as they move through their careers. Working in the UK, Hennessy, et al. (2011), found that a process of school-based co-inquiry with a university-based research team and teacher participants led to pedagogical innovations toward more dialogic teaching for those involved in their case study. Our investigation continues this line of inquiry which shows that school-based, supported TPD which takes the local, education environment into account can lead to pedagogical innovation.

Conclusion

The two-dimensional matrix adapted for this study gave us a window into what the teachers in our case study were understanding while they were still in the process of mastering the new strategies. While we do not propose this framework as the only way to examine teacher understanding, we do suggest that tracking teacher understanding is a powerful way to consider not only what *what* teachers understand, but *how* they are understanding at different points in an innovation. Examining teacher concerns can provide another window into teacher understanding – as teachers express their concerns they also reflect on what they do/do not understand and how they understand different aspects of the innovation. The dual analysis (TU and TC) also provides some information about issues of

cultural appropriateness for instructional strategies imported from different educational contexts. In our study, as teachers developed deeper understanding of the strategies and as they adapted the strategies in their own practice through collaborative lesson planning, they became more confident with fewer concerns about cultural appropriateness. Elliott (2014) has suggested that what makes pedagogy travel well across international contexts is not specific pedagogical practices (e.g., whole-class teaching), but attention to student motivation and engagement while “significant elements are shaped and incorporated within models of practice that are appropriate for the host culture” (p. 39). Our data show that teacher understanding and teachers’ confidence in their ability to incorporate new models of practice work in tandem, opening up the opportunities for innovation. As one teacher said in her final reflection:

By knowing about QtA, I no longer ask questions by following the teachers’ guide but I play by ear and go along with the pupils flow and discussions. From there, I adjust my questioning and get them to explain and discuss.

(Reflection3_Gr_25.11.11)

Thus, we see the changes in teacher understanding and teacher concerns as being more than a simple reflection of the features of each stage of the innovation programme. We suggest that examining teacher understanding provides a window into the teacher learning process, which allows those involved in TPD to consider the development of the innovation rather than waiting for anticipated outcomes.

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Data Availability Statement

Anonymised data associated with this project can be found at

<https://researchdata.nie.edu.sg/dataset.xhtml?persistentId=doi:10.25340/R4/DKMMCC>

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Appendix A. Coding of Teacher Understanding (based on Anderson, et al., 2001)

Knowledge Dimension

Factual Knowledge – discrete isolated content elements / ‘bits of information’. It includes teacher knowledge of terminology and knowledge of specific details, elements and basic facts about QtA, NfM, classroom interactions and reading comprehension.

Conceptual Knowledge – main concepts and principles and structure of QtA, NfM, classroom interactions and reading comprehension, knowing how they are organized and implemented, being able to recognize the mentioned strategies and differentiate them from others. It includes their knowledge of theories, models, classifications, categories and generalizations.

Procedural Knowledge – how to plan and carry out procedures for QtA, NfM, reading comprehension and classroom interactions. It includes sharing prior practices as well as what they want to do or they think they would have done regarding implementing QtA, NfM and reading comprehension.

Metacognitive Knowledge – awareness of their own understanding of QtA, NfM, reading comprehension and classroom interactions, awareness of their own practices and performance.

Cognitive Dimension

Remember - relevant knowledge from long term memory, with or without a prompt. This category has to do with identifying, retrieving, recalling or recognizing relevant knowledge, events, procedures, etc.

Understand – relevant knowledge about QtA, NfM or reading comprehension through interpreting, exemplifying, classifying, summarizing, inferring, comparing or explaining.

By coding of understanding only of QtA, NfM and reading comprehension our data analysis is more targeted in answering our research questions and more consistent. We code it as

“Understand” only when there is evidence of connecting the ideas and not just giving information “bit by bit”.

Apply – use of relevant knowledge through real or hypothetical applications. This covers carrying out familiar or unfamiliar tasks, activities, strategies. This includes when teachers talk about how they have applied the knowledge, how they want to apply the knowledge, how they might apply the knowledge in their classroom teaching.

Analyse – this category covers differentiating, organizing, attributing or deconstructing. This includes evidence of examining parts or components of the strategy, seeing how different elements can be organized or fit together, as well as understanding or deconstructing different points of view.

Evaluate - making a judgment based on some criteria or standards, measuring against a set of standards. This includes judging, critiquing, detecting inconsistencies, and/or considering appropriateness.

Create – generating relevant knowledge, creating alternatives, reorganizing relevant knowledge in new ways. Planning, designing, and constructing relevant knowledge, materials, resources or products.

For details and examples of the coding definitions, see Kogut, Huynh & Silver, 2016.

Table 1. Teacher Background: Summary

Educational qualifications	3 teachers had a teaching diploma (or equivalent); 3 had a BA in Education
Specialisation during pre-service training	3 specialised in English language; 1 had a 'General Education' degree; and 1 specialised in Science with additional teaching methods courses in English Language
Years of teaching	4 teachers had 12 or more years teaching experience (with 1 teacher having more than 20); 1 teacher had less than 10 years and 1 teacher was in the first year of teaching
Subjects (teaching)	All were teaching English Language and at least one other subject. 4 of them were teaching three or more different subjects. The additional subjects varied considerably: Math, Art, Science, Social Studies, Music, Health Education
Course materials (for English Language classes)	All were using course materials approved by the Ministry of Education with additional 'assessment books' containing practice exercises (primarily for grammar)
Professional Development	All except the newest teacher had engaged in professional development for reading comprehension through school-based workshops or school-based, action research endeavours (including Teacher Learning Circles)
Language(s) most commonly used at home	All used English plus one other language at home (Mandarin or Malay). Two also used a 3rd language at home (a non-Mandarin Chinese language)

Table 2. Innovation Project Overview

January	Direct Instruction (DI)	Term Break	Practice Stage (PS)	Term Break
Start of school year	Sessions 1-9 (Jan-Apr 2011) – discussion of readings, modelling strategies & video viewing, lesson plan critique, lesson planning	28 May – 26 June	Sessions 10-20 (May-Nov 2011) – lesson practice (role play), lesson plan revision, planning of additional lessons (for use in subsequent year)	19 Nov – 31 Dec
	POC 1 & 2 (Jan & March 2011) – based on baseline lesson observations		POC 3 & 4 (July – Sept, 2011) – based on innovation lesson observations	
	Written reflection 1 (March 2011)		Written reflections 2 & 3 (Aug & Nov 2011)	

Table 3. Comparison of teacher understanding: Direct Instruction/ Practice Stage (% of overall frequency of comments during that stage)

Knowledge Dimension	Cognitive Process Dimension																							
	Remember				Understand				Apply				Analyse				Evaluate				Create			
	DI		PS		DI		PS		DI		PS		DI		PS		DI		PS		DI		PS	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Factual	169	0.058	10	0.018	509	0.175	15	0.027	55	0.019	0	0	3	0.001	0	0	12	0.004	0	0	0	0	0	0
Conceptual	7	0.002	0	0	94	0.032	7	0.012	2	0.001	0	0	6	0.002	1	0.002	8	0.003	1	0.002	0	0	0	0
Procedural	22	0.008	115	0.205	147	0.05	123	0.219	1739	0.597	2919	5.203	26	0.009	221	0.394	50	0.017	116	0.207	0	0	0	0
Metacognitive	2	0.001	30	0.053	29	0.01	71	0.127	27	0.009	310	0.553	0	0	87	0.155	7	0.002	63	0.112	0	0	0	0
Total	200	0.069	155	0.276	779	0.267	216	0.385	1824	0.626	3229	5.756	35	0.012	309	0.551	77	0.026	180	0.321	0	0	0	0

Table 4. Concerns Voiced by Participating Teachers, by Topic (alphabetical order)

Teacher Concerns about Students	Teacher Concerns about Their Own Abilities and the Implementation
Impact of QtA on readers	Carrying out innovation lessons effectively
Selecting reading materials	Checking student understanding
Student ability to answer comprehension questions	Confidence in teaching QtA lessons
Student ability to ask questions	Controlling classroom interaction
Student academic ability	Extending discussion
	Helping students understand the text
	Increasing classroom interaction
	Motivating and involving students in discussion
	Questioning techniques during discussion
	Staying focused on topic
	Time constraints

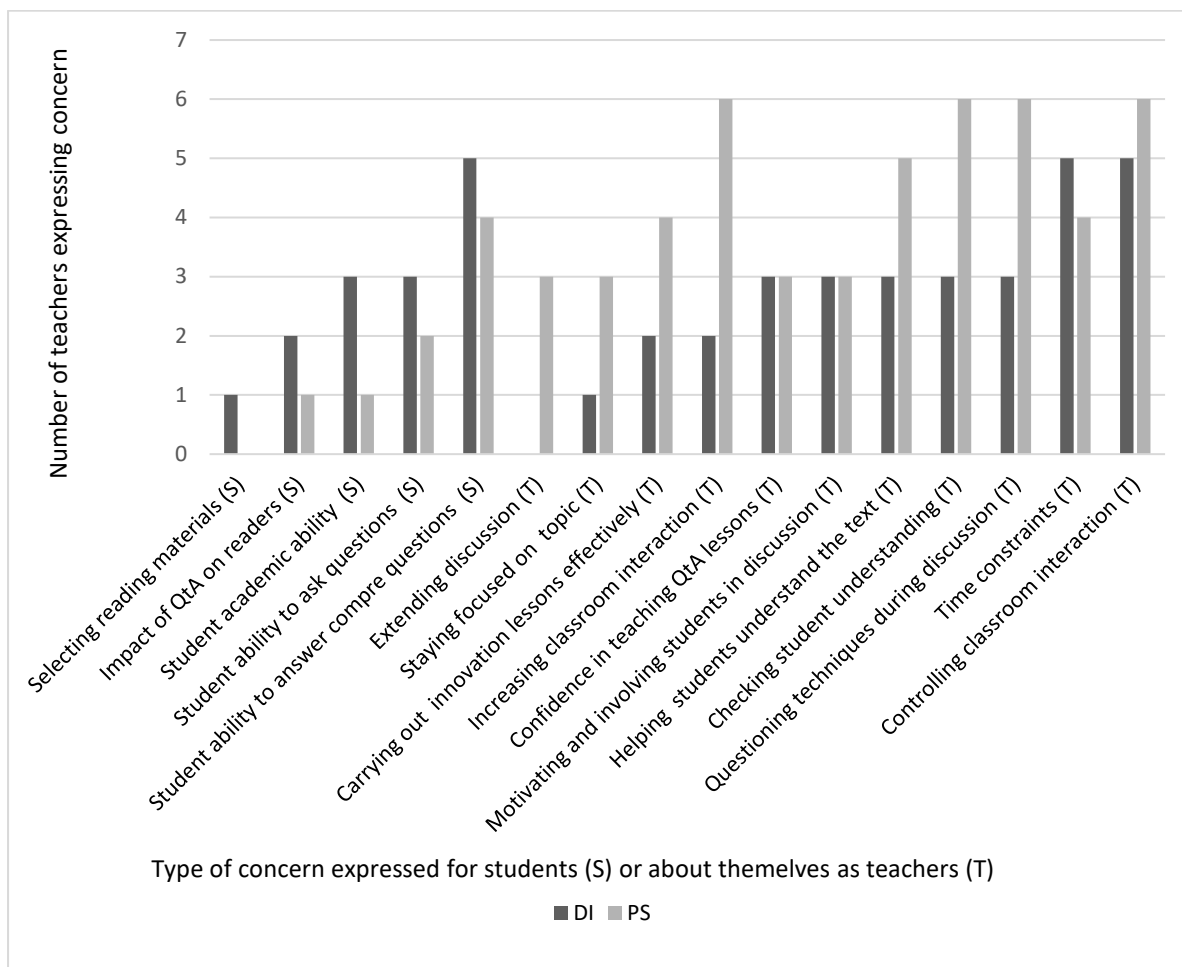


Figure 1. Changes in Concerns Expressed in Direct Instruction (DI) and Practice Stages (PS),