

# The Assessment of Teachers' Teaching Competencies: A Research Framework Based on Digital Mixed Methods Evaluation Design

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**Abstract:** *There have been many achievements in the research on teacher competence, however, the results of specializing in teachers' teaching competency (TTC) are very rare in China. This study presents a research framework to address this gap. A digital mixed methods evaluation design is utilized to assess teachers' teaching competencies in the context of Teacher Education Revitalization. More specifically, a digital mixed methods analysis with NLP Wordnet analysis (qual) and NLP analysis using TF-IDF algorithm (quan) is used in the first phase to identify key information relevant to teachers' teaching competency in educational policy. Then, in the second phase, this study investigates MEd students' perceptions of teachers' teaching competency through a questionnaire variant of convergent design. Finally, possible explanations will be given to the convergent results based on educational policy structural context. We hope researchers in the future can adopt the digital mixed methods evaluation design in other educational fields.*

**Keywords:** teaching competency, teacher education, policy assessment, digital approach, mixed methods design

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## 1. Introduction

The concept of competence proposed by McClelland (1973) has become a foundational framework for assessing teachers' professional performance and guiding their continuous professional development. While, the definition of teacher competence was continuously modified because of both internal and external education innovations and reforms. With new changes, there will be new demands on teacher competence (Cheng & Cheung, 2004). In terms of studies on teacher competence, the process model emphasized that knowledge and understanding as intrinsic and essential inputs in a successful performance; the cognitive model conceptualizes competence as rooted in the cognitive structures of knowledge and understanding that guide effective professional action. These definitions and models provided important references in the research of teacher competence.

There have been many achievements in the research on teacher competence in China, however, the results of specializing in teachers' teaching competency are very rare (Hao, 2015; He,

2014). Since the Ministry of Education (MOE) issued a policy referred to the Action Plan of Teacher Education Revitalization (APTER) (2018-2022), there will be new requirements on teachers' teaching competency. The existing literature mainly utilized Delphi method, survey research design, or both of them, to conduct relevant research; and most of articles examined what teaching competencies may be included from teachers' perspective; then, differentiated teachers' teaching competency models were put forward relying on the contextual teaching requirements. However, there is a lack of MEd students' perspectives to systematically assess teachers' teaching competency in the context of Teacher Education Revitalization because the reform is still at its early stage (Rao, 2020), though APTER proposed to promote the development of training program for MEd students. Therefore, this study aims to assess teachers' teaching competencies within the context of teacher education revitalization in China. Against this backdrop, this study will be guided by the following research questions:

1. What are new requirements regarding teachers' teaching competencies within APTER? (mixed)
2. What are MEd students' perceptions of teachers' teaching competency in the context of Teacher Education Revitalization? (quan)
3. What are MEd students' perceptions of how teachers' teaching competency can be improved? (qual)

## 2. Literature Review

The database of "teaching competency" was searched in Chinese National Knowledge Index (CNKI), and seven articles (Table 1) were selected in this study. Differentiated teachers' teaching competency models were proposed due to the contextual teaching requirements. Zhou (2012, 2014) put forward two different distance teaching competency models for teachers based upon two underlying theories. Relying on Behavioral Event Interview, distance teaching competencies should contain factors such as information literacy, media expression, and interactive ability. He also analyzed teachers' distance teaching competencies, including teaching cognition, information processing, teaching implementation, process management, by applying the Grey System method. In teaching competency model of research university teachers, Hao (2015) categorized three themes for research university teachers: research support ability, teaching transformation ability, and emotions and attitudes. He and Xiong (2015) developed four categories, which consist of knowledge literacy, teaching ability, professional character, and personality traits, for teachers' teaching competencies. Information literacy, teaching personality, teaching interaction, and teaching management, constituted teachers' MOOC teaching competencies. Liao and Zhang (2017) distilled four aspects: personality traits, teaching knowledge, professional literacy, and teaching management, to construct SPOC mixed teaching competency model for teachers. Hao and Pan (2017) generated four nuanced flipped classroom teaching competencies for teachers: knowledge, skills, traits and motivation, attitudes and values.

From abovementioned teaching competency model, it can reveal that teachers' core teaching competencies in China encompass three aspects: teaching knowledge, information literacy, personality traits. Along with these core teaching competencies, the contextual teaching competencies proposed and assessed by different researchers could be a more accurate and holistic view in teacher assessments. Thus, there is a need to understand the new requirements regarding teachers' teaching competencies in the background of teacher education revitalization.

Per the results of classification, the existing literature mainly utilized Delphi method, survey research design, or both of them, to conduct relevant research. For example, Liao and Zhang (2017) adopted Behavioral Event Interview to collect data and construct the SPOC mixed teaching competency model for teachers; then tested the validity of the model through implementing questionnaire survey. Besides that, He and Xiong (2015) constructed teachers' teaching competency model by analyzing 27 articles and interviewing 23 teachers with Delphi method; and Hao (2015) employed qualitative method, consisting of 18 interviewees and 23 documents, to collect data for the construction of teaching competency model of research university teachers. There is lack of big data analysis technique in teaching competency assessment. In terms of the participants, existing studies have explored the teaching competencies from teachers' perspectives, limited attention has been paid to the viewpoints of MEd students.

**Table 1: Teachers' teaching competency in core literature of CNKI**

| Literature             | Methodology  | Participants         | The proposed teachers teaching competency  |
|------------------------|--|----------------------|--|
| Zhou (2012)            | Delphi method/<br>Quan (survey<br>research design) | 22 / 251<br>teachers | distance teaching competency model (e.g.,<br>information literacy; media expression;<br>interactive ability)   |
| Zhou (2014)            | Delphi method                                      | 22 teachers          | distance teaching competency model (e.g.,<br>teaching cognition; information processing;<br>teaching implementation; process management)               |
| Hao (2015)             | Qual (interview/<br>document)                      | 18 teachers          | teaching competency model of research<br>university teachers (research support ability;<br>teaching transformation ability; emotions and<br>attitudes) |
| He & Xiong<br>(2015)   | Qual (document)/<br>Delphi method                  | 23 teachers          | general teaching competency model (knowledge<br>literacy; teaching ability; professional character;<br>personality traits)                             |
| Yan (2015)             | Quan (survey<br>research design)                   | 95 teachers          | MOOC teaching competency model (e.g.,<br>information literacy; teaching personality;<br>teaching interaction; teaching management)                     |
| Liao & Zhang<br>(2017) | Delphi method/<br>Quan (survey<br>research design) | 15 / 139<br>teachers | SPOC mixed teaching competency model<br>(personality traits; teaching knowledge;<br>professional literacy; teaching management)                        |
| Hao & Pan<br>(2017)    | Delphi method/<br>Quan (survey<br>research design) | 14 / 105<br>teachers | flipped classroom teaching competency<br>(knowledge; skills; traits and motivation;<br>attitudes and values)   |

### 3. Theoretical Perspective

Through integrating previous policy analysis discussions (Bell & Stevenson, 2006; Buse et al., 2005; DeLeon & DeLeon, 2002; Rizvi & Lingard, 2010) into the policy analysis literature, Jie (2016) constructs the education policy framework (Figure 1), which centers on content, context, process and actors. It is very imperative to point out that the education policy framework is considered as a compass or lens to define teaching policy research but not as the rule. The education policy framework is appropriate for this research because it provides a more holistic way to analyze policy content in APTER, assess teaching policy implementation from MEd students' perspective, and understand policy structural context to reveal teachers'

teaching competency constraints. In the education policy framework, teaching policies (content) relate to specific school- and classroom-level practices, and relate to factors such as classroom management, differentiated teaching and support for students, teacher-student relationships, and programs to support students' interest and motivation in school (Tobin et al., 2015). Policy implementation (process) has been defined variously (Bhola, 2004) and is often the most neglected phase of policy making (Buse et al., 2005). However, this is arguably the most important phase of policy making because if policies are not implemented, the policy outcomes will not be those which were sought. Actors are at the center of the education policy framework. Schools, students, the Ministry, parents, and even private tutors are all stakeholders that will be impacted by policy move. Policy structural context, which may have an effect on education policy, is the relatively unchanging elements of the society and may include factors such as the employment base or technological developments (Jie, 2016).

In this study, with the combination of education policy framework and APTER policy content, it will center on teachers' core teaching competency by figuring out what the teaching policy issues are. When education policy framework is integrated into teaching policy implementation process and policy actors, this article will explore MEd students' perceptions of teachers' teaching competency. It will also explain what shaped MEd students' perceptions of teachers' teaching competency by connecting the education policy framework and APTER structural context, referring to employment base or technological developments.

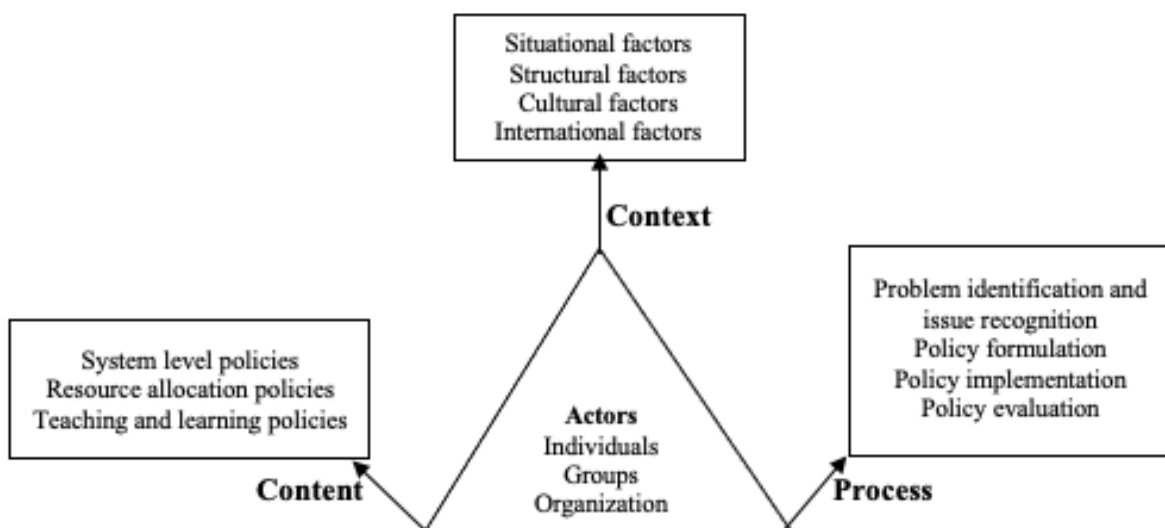


Figure 1: The education policy framework (Jie, 2016)

#### 4. Research Design

A digital mixed methods evaluation design (Figure 2) is employed in this study through extending mixed methods evaluation design (Creswell & Clark, 2017) with digital mixed methods research design (O'Halloran et al., 2016). The mixed methods evaluation design is appropriate for needs assessments, process evaluation and outcomes assessment (Creswell & Clark, 2017), and the assumption for it is different aspects of reality needs differentiated inquiry methods (Creswell & Tashakkori, 2007; Sandelowski, 2000). The digital mixed methods research design is an extension of a multistage design involving qualitative collection and analysis of multimodal data, transformation to quantitative data, data mining using computational method, and information visualization and exploration (O'Halloran et al., 2016).

In this study, the digital mixed methods evaluation design involves three stages. First, drawing from the digital mixed methods research design (O’Halloran et al., 2016), NLP qualitative and quantitative analysis is used to develop meta-inferences (Chang et al., 2021) about core teachers’ teaching competencies within APTER (needs assessments). And steps in digital mixed methods evaluation design with NLP include applying NLP qualitative-type techniques, such as Wordnet to identify thematic clusters; applying NLP quantitative-type techniques, such as Term Frequency-Inverse Document Frequency (TF-IDF) method to identify thematic units based on probability distribution; and conducting integrative analysis by merging all results to identify meta-inferences (Chang et al., 2021).

$$tf_{idf_i} = tf_i * idf_i = \frac{n_{i,j}}{\sum_k n_{k,j}} * \log \frac{|D|}{|\{j: t_i \in d_j\}|}$$

TF = (Total appearance of a word in document) / (Total words in a document)

IDF = log (All document number / Document frequency)

Then, the preliminary mixed methods results can be used for further quantitative testing (Fetters, 2019). In addition, in the following design, we add an open-ended question to validate and embellish the quantitative data. Hence, the second stage is a process/implementation assessment with questionnaire variant of convergent design (Creswell & Clark, 2017). Finally, this study interprets these research questions by the integrated results.

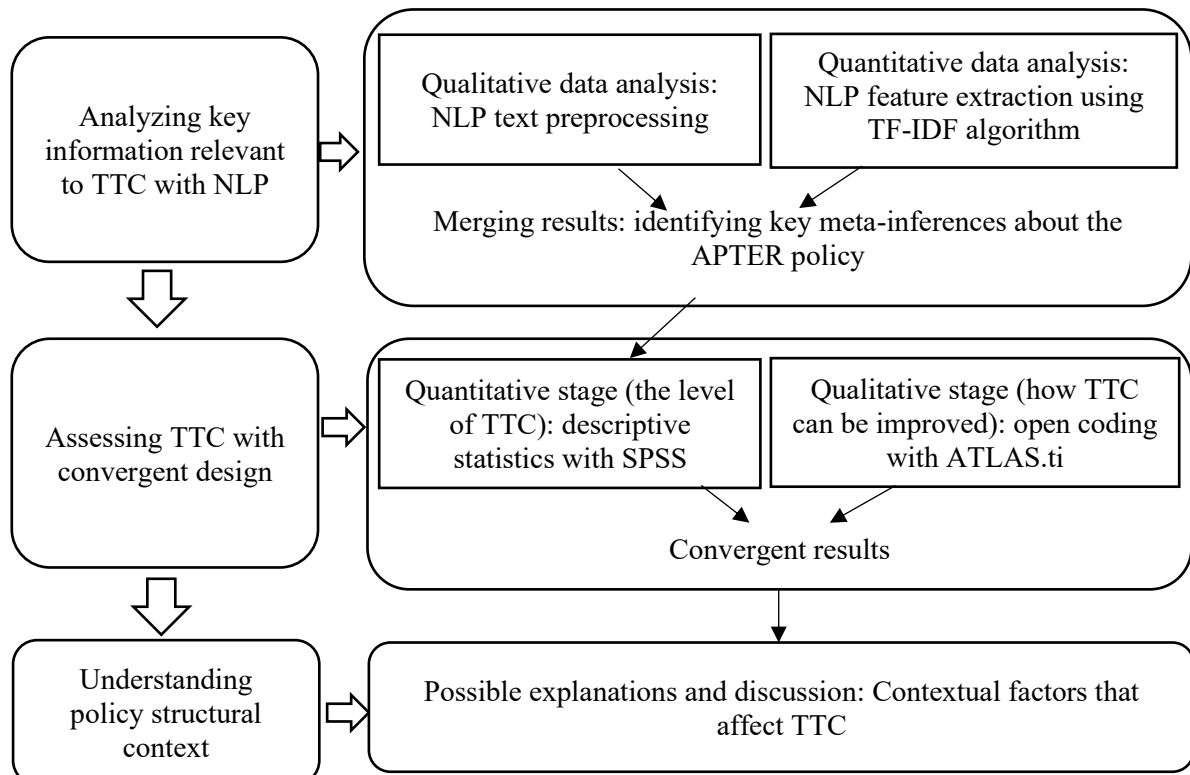


Figure 2: A digital mixed methods evaluation design

## 5. Conclusion

Through extending mixed methods evaluation design with digital mixed methods research design, this study proposes a research method, digital mixed methods evaluation design, to comprehensively understand teachers' teaching competency in the context of teacher education revitalization. The evaluation process may involve needs assessment, process evaluation, and impact evaluation. Using big data analysis technique for education evaluation can reduce researchers' bias and save time for data analysis. We hope researchers in the future can adopt the digital mixed methods evaluation design in other educational fields.

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## Conflict of Interest Statement

The authors declare that there is no conflict of interest regarding the publication of this study.

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