

# Professional Development of Outstanding Secondary School Physics Teachers—Analysis Based on the Personal Life Histories of Special Class Secondary School Physics Teachers

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## Abstract

Special class secondary school physics teachers represent outstanding secondary school physics teachers in China. This paper analyzes the personal life histories of 13 outstanding secondary school physics teachers. We coded and analyzed the sample materials and summarized the laws of professional development of outstanding secondary school physics teachers. The study shows that cultivating outstanding secondary school physics teachers takes a relatively long time. Their professional development can be divided into five stages: the pre-service learning period, the initial adaptation period, the exploration and skill-developing period, the maturing innovation period, and the excellence and advancement period. Individuals' own efforts and continuous learning, guidance from master teachers and experts, and support from family and school play an important role in the professional growth of outstanding secondary school physics teachers. Outstanding secondary school physics teachers can apply lifelong learning, do educational research, and develop their own distinctive physics teaching styles.

**Keywords:** professional development, outstanding secondary school physics teacher, literature review, life history

## 1. Introduction

As distinguished representatives of a vast number of excellent teachers and educational workers and leading pioneers in education, outstanding teachers serve as a powerful engine carrying out the fundamental task of establishing moral education and improving the quality of teaching. They are the key driving force for building a country with strong human resources and achieving the great rejuvenation of the Chinese nation (Wang & Yang, 2020). In 2014, the Ministry of Education issued "Opinions on the Implementation of the Teacher Excellence Training Program," which has greatly promoted the in-depth development of the training and practice of outstanding teachers. In 2018, the Ministry of Education issued the "Opinions 2.0 on the Implementation of the Teacher Excellence Training Program." (Song & Yuanhang, 2021) By implementing the Teacher Excellence Training Program, the professional level of backbone teachers has been effectively enhanced, and many truly outstanding teachers have been cultivated (Wang et al., 2019).

In order to elucidate the factors that influence the professional growth of outstanding teachers, we analyzed outstanding secondary school physics teachers' biographical materials to clarify the factors that influence their professional growth. Outstanding secondary school physics teachers have high moral integrity, unique educational ideas, excellent subject knowledge and laboratory skills in physics, a high reputation, and broad influence. They constantly pursue professional development and have transformed from "teacher" to "researcher." They are expert teachers who have been recognized by students, colleagues, and experts adapting to and leading the reform of physics education in secondary schools (Sun & Liu, 2021). In this study, we define outstanding secondary school physics teachers as those in secondary schools who have received the title of special class teacher.

This article is based on a documentary analysis that systematizes the professional growth of outstanding secondary school physics teachers. Through a detailed textual analysis of the life history of special class physics teachers in secondary schools, we summarize the patterns of professional development of outstanding secondary school physics teachers. The findings of this study can help enhance the professional development of physics

teachers and promote the development of the physics teaching force. The research objective is to grasp the law of professional growth of outstanding middle school physics teachers, and to provide an implementation plan for the cultivation of outstanding middle school physics teachers.

## 2. Literature Review

Because teachers are the key to school education reform, effective professional development is essential for teachers to improve students' learning success. A major goal of teacher professional development is often to become a better teacher and to promote student learning achievement (Sandal, 2021). Teacher s' professional development can be defined as the process and activities used to enhance professional knowledge and skills of teachers, and to change attitudes toward teaching to increase student achievement (Ufnar & Shepherd, 2019).

Teachers go through developmental stages, which may be labeled differently in different national, cultural, or contextual variations (Keller-Schneider, Zhong, & Yeung, 2020). Taking the change of teachers' attention in their growth as the research object, Fuller put forward the theory of pre-service teachers' professional development stage in the form of questionnaire survey. There are five developmental stages: pre-teaching concerns, early concerns about survival, teaching situational concerns, and concerns about pupils. Fuller's theories led to a model of personalized teacher education designed to match the phases experienced by teachers, introducing the idea that professional development must be differentiated in accordance with teacher needs (Fessler & Rice, 2010). Huberman uses these seven stages to describe the career cycle of teacher professional development. The first is "careers entry: survival and discovery", which takes place during the first three years of teaching. The second stage is "stabilization," which may take four to six years of teaching. Between the 7th and 25th years of teaching, two phases may occur intermittently: "experimentation/diversification" and "reassessment/interrogation ". These two phases are interrelated, and teachers may go back and forth between them. Similarly, any of these teachers may have roughly the following "serenity" or "conservatism" phases during their 26 to 33 years of teaching. Teachers can also continuously swap positions between the two stages (Villegas-Torres & Lengeling, 2021).

The life history approach occupies an important place in the Chicago sociological research tradition and has been used extensively in educational research since the 1980s (Choi, 2017). As a qualitative research method, life history research aims to understand the interaction between an individual's life story and the context in which the story takes place (Emerson, 2020; Hatch & Newsom, 2010). Life history research originated in the early twentieth century with American anthropologists studying Native American chiefs' autobiographies. Since the 1930s, the life history research methods declined with the prevalence of quantitative and statistical research methods. Since the 1980s, however, under the postmodernist trend of exploring subjectivity, life history research has once again attracted the attention of researchers and has been widely used in the fields of sociology, anthropology, psychology, and education (Goodson & Choi, 2008).

Teachers' individual experiences influence their professional and educational values, which are formed during their studies and lives. Teachers' professional and educational values are closely related to their personal experiences, which influence their beliefs and styles of teaching. What teachers have experienced in the past becomes a "history of impact" that hugely influences their future ways of thinking and behavior (García González & Sierra, 2020). A teacher's personal life history entails the significant events and experiences throughout the teacher's life, education, and work, and the teacher's experiences in and reflections on their "life-world of education," as narrated by themselves or others. It is a description of the real and contextualized events that have occurred or are occurring in the teacher's daily life, classroom, and educational research, which can reflect the teacher's emotions, attitudes, and values. Personal life history is a window through which teachers construct their own understanding of education, and an important channel through which others could understand teachers, an important lens through which the professional growth of outstanding teachers can be studied and interpreted. By detailing teachers' life history in educational contexts, the research of teachers' life history can provide a better understanding of teachers' lives and practices and clarify the dilemmas and aspirations of teachers in their own development (Li & Gao, 2021; Zhao & Goodson, 2013).

Chinese scholars have used the life history approach to study special class teachers, National Teachers of the Year in the United States, and kindergarten teachers. For example, using the life histories written by 36 special class teachers in the "Life of Famous Teachers" column of the journal *People's Education* from 2003 to 2005 as samples, Dingrong Hu used the content analysis method to quantitatively describe and analyze the personal background affecting the growth of outstanding teachers, the factors affecting the career choice and success of outstanding teachers, and the key events affecting the growth of outstanding teachers (Hu, 2006). Based on a study of the personal life histories of six recipients of the title "National Teacher of the Year" in the United States from 2009 to 2017, Lele Hu pointed out that personal life histories have a significant impact on the teaching

excellence of National Teachers of the Year in the United States (Hu, 2018). Lu Huang and Jianyin Liu used content analysis to study the biographies of 37 outstanding teachers in primary and secondary schools. They extracted key events that reflect the distinctive characteristics and paths of growth of outstanding teachers and then coded the keywords for each of these key events. Lastly, they categorized and analyzed the keywords to summarize the basic personal and professional characteristics of outstanding teachers, proposing ways to promote the professional growth of outstanding teachers (Huang & Liu, 2014). Using the life history research method, Xiangling Li studied an outstanding kindergarten teacher with 16 years of teaching experience by examining his/her childhood life, studies and life in primary and secondary school and in the preschool education college, and experiences after starting the career of a preschool teacher, summarizing his/her outstanding qualities, factors contributing to his/her professional development, and confusions encountered in his/her professional development (Li, 2017). The Teacher Research Center of the Beijing Academy of Educational Sciences conducted interviews with 20 special class teachers in Beijing, summarizing their path of professional growth, pedagogical ideas and practices, distilling the advanced pedagogical ideas and perspectives of the special class teachers, and providing vivid and lively cases for teachers' professional development (Yu, 2011). The teachers involved in the above studies include teachers in secondary schools, primary schools and kindergartens, and the subjects taught include Chinese language, mathematics, physics, biology, history, politics, moral education, etc. In summary, there is not much literature on using the life history approach to study secondary school physics teachers in China.

### **3. A Textual Analysis of the Personal Life History of Outstanding Secondary School Physics Teachers**

We conducted a textual analysis of the personal life history of 13 special class secondary school physics teachers as research subjects. The information and life history of the subjects of research were collected mainly through the CNKI database and published books. The 13 secondary school physics teachers were: Xu Liang (Liang, 2019), Jiujiang Wen (Jiang & Deng, 2016), Zhihu Zheng (Zheng, 2019), Changhong Tao (Tao, 2014), Yongchang Qian (Qian, 2018), Mingyi Su (Fu, 2017), Weidong Meng (Zhang & Gong, 2014), Jitai Yu (Chen, 2017), Xuejun Liang (Liu & Sun, 2015), Bushi Xie (Xie, 2013), Gao Wang (Wang, 2014), Shi Lin (Chen, 2011), and Yajin Gao (Yao, 2017). To facilitate the study, we coded the personal life history materials of the 13 special class secondary school physics teachers, including basic information (gender, the school he/she graduated from, level of education, school where he/she works, and time of being awarded as a special class teacher), stage of professional development, key events, educational research, and styles of teaching.

#### *3.1 Basic Information*

The statistical analysis results showed that among the 13 special class secondary school physics teachers, there were two female teachers and 11 male teachers. In terms of the level of education, one graduated from Beijing University and 12 others graduated from teacher education colleges (one graduated from a secondary teacher training school; five graduated from teacher training colleges and obtained a specialist's degree; six graduated from normal universities and obtained a bachelor's degree). After starting to work as a teacher, the teachers who graduated from a secondary teacher training school obtained his/her bachelor's degrees and master's degrees in education. The three teachers who graduated from the teacher training colleges later also obtained their bachelor's degrees. A total of six teachers studied for a master's degree in education or completed a postgraduate course.

The shortest period of entry into the workforce to being awarded as a special class secondary school physics teacher was 17 years, the longest was 29 years, and the average was 22.75 years. This indicates that the growth of outstanding secondary school physics teachers takes a longer period. At the time of being named a special class secondary school physics teacher, three teachers served as educational researchers at the education county's bureau or the district. All others were teaching in secondary schools. After being named a special class physics teacher, two teachers became educational researchers in physics at the provincial or municipal level.

#### *3.2 Stages of Professional Development*

By analyzing the experiences of the 13 secondary school physics teachers, we divided the professional development of outstanding secondary school physics teachers into five stages: the pre-service learning period, the initial adaptation period, the exploration and skill-developing period, the maturing innovation period, and the excellence and advancement period.

(1) Pre-service learning period. This is the period of schooling before they joined the workforce as teachers. In general, as students, they had a strong desire to learn and a very clear learning goal. They learned actively with a persistent and broad interest in learning and possessed a personal and lasting motivation to learn. As they grew older, from primary school to university, they gradually developed a clearer personal development goal and

developed a career development plan. During the pre-service learning stage, they were attracted to the profession of teaching as the ideal and their aspiration. This long-lasting spiritual motivation was intrinsic to their growth into outstanding physics teachers and an important factor in determining the future level of development of teachers.

(2) Initial period of adaptation. As novices, they actively adapted themselves to the working environment, strengthened self-learning, and actively sought advice from others. In the process of learning and imitating, they learned to apply their professional theoretical knowledge to teaching physics, improving their skills in lesson preparation (preparation of teaching materials, getting the students prepared, and preparation for class) and course design in actual practices. In the process of classroom teaching, they exercised basic teaching skills, improved teaching techniques and accumulated teaching experience. During the initial stage of adaptation, they further consolidated the knowledge of education in practice, improved the mastery of educational theories, and developed teaching skills and management skills. This stage lasted for about three years.

(3) Explorative and skill-developing period. After adapting to teaching, based on the classroom teaching of physics, they explored how to reform teaching specific problems when teaching physics. They continuously learned from various teaching practices such as classroom teaching, open class, competition for high-quality classes and other teaching competitions, research projects, guiding students in competitions, etc. They summarized their teaching experience by continuously reflecting on their own teaching. They became more proficient in basic teaching skills and significantly improved their teaching abilities. They were able to grasp the teaching materials of physics correctly and the knowledge structure of physics scientifically. They paid attention to and fully understood the needs of students in learning and are fully capable of teaching and management tasks. They were able to master the physics classroom and successfully complete various teaching and management tasks and gradually grew into backbone physics teachers of the school. This stage generally lasted from the 4th year to the 10th year in their career.

(4) Mature period of innovation. At this stage, they were able to control physics classroom teaching excellently, and the focus of teaching transitioned from students' grades to the development of students' competence in the subject or core competencies. They regularly reflected on their classroom teaching and teaching ideas, carrying out teaching reform and educational research in conjunction with teaching practice. They were able to continuously make innovations in teaching practice based on advanced knowledge of educational theories, gradually forming their personal characteristics in teaching physics and growing into regional outstanding physics teachers. This stage generally lasted from the 11th year to the 15th year in their career.

(5) Period of excellence and advancement. Growing into outstanding teachers, they devoted themselves to education with great enthusiasm and continued reflecting on, polishing, and improving their physics teaching. They applied research methods in educational sciences to experiment and reconstruct the theories of physics teaching, thus achieving further advancement in professional growth. At this stage, they deepened their knowledge, understanding, and interpretation of the nature and laws of education in their reflections on education and teaching in physics and continuously improved their practical, academic, and educational management abilities in teaching. While integrating the acquired educational theories with their own teaching practices, they formed their own educational theories through summarization and innovation. In the process of educational research based on theory and practice, they refined and formed their personalized ideas and styles of teaching in physics. For example, Mr. Changhong Tao (Tao, 2014) put forward a theoretical teaching model in "Basic Characteristics of the Teaching of Physics," which constructs and improves the conceptual system in teaching modern physics. Xu Liang (Liang, 2019) combined the basic theory of cognitive psychology with the specific learning process of physics, which deepens and enriches the theory of cognitive psychology in physics subjects. These theoretical achievements play a guiding and leading role for secondary school physics teachers. This stage generally occurred from the 16th to the 25th year in their work. They grew into expert teachers after around 20 years of working.

Looking at the growth of outstanding secondary school physics teachers, we also find that they all pay great attention to their own learning. They all have a sense of lifelong development and lifelong learning ability. Their learning is not limited to reading books and journals specializing in physics, but they also seriously read literature on physics, education, philosophy, etc. Of course, in the process of personal growth, they also learned from others (peers, experts, etc.) in an open-minded manner, constantly drawing on various theoretical and practical knowledge to enhance the development of their own level of educational theory and practical teaching ability. Their love for education is an important motivation to achieve lifelong learning. Moreover, continuous lifelong learning provides a constant and fresh impetus for their professional development and is important for their growth into outstanding physics teachers.

### 3.3 Critical Incidents

Generally speaking, a critical incident is an event or situation that marks a major turning point or moment of change in a person's life (Hall & Townsend, 2017). For teachers, a critical incident is an incident that has a significant impact on and provides inspiration to a teacher's perceptions about education and practices of education during the course of their personal development. The elements of a critical incident include time, place, and people. A critical incident can be a complete course of event, a significant part of an event, or exceptional detail. Its duration may be a short moment, a short or long period, a small event, a project, etc. Critical incidents can contribute to teachers' professional growth in the following ways (Badia, Becerril, & Gómez, 2021; Karimi & Nazari, 2019; Shapira-Lishchinsky, 2011): (1) Critical incidents promote teachers' voluntary professional action. Through continuous self-reflection, teachers possess a strong sense of personal responsibility for their teaching practice; (2) Critical incidents promote teachers' self-driven professional development, making them aware of the importance of acquiring and improving their teaching skills through self-reflection; (3) Critical incidents enable teachers to take control over their professional behavior and professional development.

Critical incidents play a significant role in the professional growth of outstanding secondary school physics teachers.

First, the influence of key persons. By analyzing the life history of outstanding secondary school physics teachers, we found that key persons played a vital role in the early stage of their professional development. At the beginning of their teaching careers, the schools arranged for them to be mentored by backbone teachers or master teachers, and these "masters" played an essential role in "passing on the knowledge." Under the guidance of the "masters," the young physics teachers studied the teaching materials, learned the basic teaching skills such as lesson preparation and teaching, exercised and improved their teaching ability, accumulated teaching experience and theoretical knowledge, and actively reflected on and innovated their teaching. At the same time, during the personal growth of young physics teachers, the schools also employed education experts from outside the school (such as educational researchers in physics, research experts in physics education, etc.) to provide comprehensive guidance and training in educational theory, pedagogical behavior, and educational research and leadership. Under the theoretical and practical guidance from experts, young physics teachers gradually learned to apply their theoretical knowledge to their teaching practice, enhanced their teaching ability, level of educational theory, and ability in educational research, and grew into backbone physics teachers. As Mr. Qian Yongchang narrated (Qian, 2018), "Looking back on my own growth, I was fortunate to meet many excellent teachers who appeared at the right time at each stage and became my benchmark, giving me the motivation to keep moving forward."

Second, the influence of key events. Various teaching and research events such as high-quality lesson competitions, teaching competitions, educational reforms, and the publication of the first article were key events for young physics teachers to grow into outstanding physics teachers. From the teachers' self-reports, these events were significant to the teachers themselves, e.g., "it made me continue to improve my professional way of thinking and professional competence rapidly and feel better and better about my profession;" "I could not hide my excitement." Physics teachers learned experiences and lessons from various key events such as successes, setbacks, or failures in a timely manner. They learned from others (peers, experts, etc.) or asked for advice while proactively engaging in self-reflection, enriching and improving their own theories of teaching in physics, adjusting their professional development plans, and effectively enhancing their own professional development.

Third, the support of families and schools. Strong family support was an important guarantee of success for outstanding physics teachers, and the support from schools provided an important impetus toward excellence.

### 3.4 Educational Research Capacity

Writing educational research papers is important during the professional development of outstanding secondary school physics teachers. The quality of educational research papers and monographs directly reflects the academic quality of physics teachers and the level of their professional development (Xing, Zheng, Zhang, Liu, & Lu, 2014).

We conducted a statistical analysis of the publications of papers and monographs of the 13 special class secondary school physics teachers and combined the results with their life history in the analysis. By searching in the CNKI database, all 13 teachers had published educational research papers as of November 30, 2021, and the average number of papers published per capita as first author was 35. Among them, Liang Xu published 97 papers as first author, Wen Jiujiang published 64 papers, Su Mingyi published 57 papers, and Tao Changhong published 54 papers. The main journals of publication include *People's Education*, *Curriculum-Teaching*

Materials-Teaching Methods, Basic Education Curriculum, etc. These journals included CSSCI journals, core journals of China, and various general journals on basic education and teaching of physics. These published papers were both summaries of the personal experiences in education and teaching of outstanding secondary school physics teachers and reflections of their level of professional development as teachers.

The publication of books is also an important indicator of the level of professional competence of outstanding secondary school physics teachers. All outstanding secondary school physics teachers had monographs or teaching aids published in monograph publications. Among them, six special class teachers were involved in the compilation of physics textbooks for senior high school or junior high school as the chief editor or editor (e.g., physics textbooks for junior high school and senior high school compiled by the People's Education Press, Beijing Normal University Press, Shanghai Science and Technology Press, etc.). These achievements are not only a recognition of the quality of teaching of these outstanding secondary school physics teachers by society but also a reflection of the "excellence" of these outstanding secondary school physics teachers.

### 3.5 Style of Teaching

Style of teaching refers to one's personalized teaching style that teachers form under the guidance of a certain educational ideology and through long-term teaching practice, where they creatively use various teaching methods and skills (Ridwan, Sutresna, & Haryeti, 2019; Simões & Calheiros, 2019; SueSee, Edwards, Pill, & Cuddihy, 2019). We found that outstanding secondary school physics teachers were constantly learning and continuously engaged in critique, self-reflection, synthesizing, and enhancement through textual analysis. In the process of teaching practice, they continuously refined their teaching skills, educational research ability, and other educational abilities, gradually forming their own distinctive styles of teaching physics. For example, Xu Liang has formed the teaching characteristics of "emphasis on students, experiments, exploration and reconstruction" and the teaching style of "harmonious, dynamic, thought-provoking and learning-guided." (Liang, 2019) Qian Yongchang's style of teaching is to focus on experiments and innovation and vividly display the principles; to highlight scientific inquiry and guide students to explore the formation of knowledge; to help students to pursue their own achievements in the classroom and to promote the simultaneous generation of students' knowledge, methods, and abilities (Qian, 2018).

## 4. Conclusion

Paying attention to the growth process of teachers and strengthening the research on the regularity and stage characteristics of teachers' professional development are the major issues facing the curriculum reform. Looking at the process of personal growth of outstanding secondary school physics teachers, we find that they love their career of teaching, have deep emotions for the education profession, have developed a very high professional identification with teaching, and have strong professional beliefs. During the growth process, they were able to learn proactively and have obtained the ability of lifelong learning. In the process of self-construction from teaching practice, learning, self-reflection, summarizing experiences, and finally back to teaching practice, they constantly enrich and improve their own professional knowledge in physics, knowledge of educational theories, and practical knowledge. They have significantly improved their teaching ability, academic research ability, educational management ability, and teaching evaluation ability, and have formed their own styles of teaching physics with personal characteristics.

In conclusion, the making of outstanding physics teachers is the result of both continuous individual efforts and the collaborative and innovative nurturing of multiple parties, including universities, secondary schools, and government.

The research is based on the textual analysis of teachers' life history documents collected by CNKI, and there is a lack of direct interviews and surveys of middle school physics teachers. As a next step, we are ready to use the life history approach to study the professional development of outstanding physics teachers in secondary schools.

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