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# EXAMINING THE ROLE OF NATIONAL BOARD CERTIFICATION IN PROFESSIONAL DEVELOPMENT OF SCIENCE TEACHERS

(AMERİKA BİRLEŞİK DEVLETLERİ'NDE UYGULANAN UZMAN  
ÖĞRETMENLİK SERTİFİKASI PROGRAMININ FEN BİLGİSİ  
ÖĞRETMENLERİNİN MESLEKİ GELİŞİMLERİNDEKİ ROLÜNÜN  
İNCELENMESİ)

**Ayhan KARAMAN<sup>1</sup>**

## ABSTRACT

This study examined the meaning of undergoing the performance assessment process of National Board Certification (NBC) for science teachers. Based on the cases of four experienced science teachers, this naturalistic inquiry study indicated that NBC assessment process played an affirmational role for science teachers in their professional development. This meant that teachers completed the advanced certification process with an elevated confidence into their existing notions and ways of teaching science. However, their notions and ways of teaching science were not necessarily in favor of the ideas advocated in the contemporary science education reform movements. This suggested that pursuing advanced certification procedure strengthened the conventional notions of some teachers in teaching science rather than opening new avenues in developing a higher affiliation with the reform ideas promoted in science education reform documents.

**Keywords:** National Board Certification, National Board Certified science teachers, teacher quality, professional development of science teachers, performance assessment

## ÖZ

Bu çalışma, performans değerlendirme sistemine dayalı olan uzman öğretmenlik sertifika programına katılmanın, fen öğretmenleri için ne mana ifade ettiği konusunu inceledi. Dört tane tecrübeli uzman fen öğretmeni ile yapılan niteliksel araştırmanın sonuçları, uzmanlık sertifikası değerlendirme sürecinin öğretmenlerin mesleki gelişimlerinde teyit edici bir rol oynadığını göstermiştir. Bundan, öğretmenlerin uzmanlık sertifika programını, fen öğretimi ile ilgili varolan düşünce ve yöntemlerine olan güvenlerini perçinlemiş bir şekilde tamamladıkları sonucuna ulaşabiliriz. Fakat, bu sonuç, öğretmenlerin fen öğretimi ile ilgili varolan düşünce ve uygulamalarının mutlaka fen eğitimindeki çağdaş reform hareketlerinde savunulan düşünceler ile uyumluluk gösterdiği anlamına gelmez. Bundan yapılabilecek çıkarım, uzmanlık sertifikası programına devam etmenin, bazı öğretmenlerin fen eğitimi reform dökümanlarında savunulan görüşlere olan yakınlıklarını arttırmaları için yeni açılımlar geliştirmelerine olanak sağlamak yerine fen öğretimindeki geleneksel düşüncelerin daha da güçlenmesini sağladığı şeklinde ifade edilebilir.

**Anahtar kelimeler:** Uzman öğretmenlik sertifikası, uzman fen bilgisi öğretmenleri, öğretmen kalitesi, fen bilgisi öğretmenlerinin mesleki gelişimleri, performansa dayalı değerlendirme

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## INTRODUCTION

Educational reform is not an unfamiliar concept for Americans. Throughout the last century, reform movements have emerged periodically in order to improve the academic performances of students (Pool, Ellett, Schiavone, & Carey-Lewis, 2001). Many efforts have been made on altering certain school characteristics with an expectation of higher student achievement (Hallinan & Khmelkov, 2001), yet with little success (National Commission on Teaching and America's Future [NCTAF], 1997). Since mid-80s, the agenda in education reform initiatives has shifted from improving school characteristics to enhancing teacher quality (Hallinan & Khmelkov, 2001) because recent research findings persistently indicate that high quality teachers generate substantial improvement in student learning (Committee on Science and Mathematics Teacher Preparation, 2001; Darling-Hammond, 1999b; Goldhaber & Anthony, 2003; Haycock, 1998; National Center for Education Statistics, 1999; Pool et al., 2001; Sanders & Rivers, 1996; Wenglinsky, 2000). NCTAF (1997) phrased this reality as "no other intervention can make the difference that a knowledgeable, skillful teacher can make in the learning process" (p.8).

The emergence of the contemporary reform movements goes back to 1980's. In 1983, the publication of *A Nation at Risk: The Imperative for Educational Reform* by National Commission on Excellence in Education alerted the nation about the worsening status of American educational system and triggered standards-based reform movements in order to increase the academic achievement of students. In 1986, two national reports, *A Nation Prepared: Teachers for the 21st Century* by Carnegie Task Force on Teaching as a Profession and *Tomorrow's Teachers* by Holmes Group, argued for the necessity of transforming teaching into a profession of well-educated teachers and creating a career ladder for teachers that distinguishes and rewards accomplished teaching (Hallinan & Khmelkov, 2001; Johnson, 1987). In order to improve the professional status of teaching, Carnegie Task Force on Teaching as a Profession (1986) called for the establishment of a National Board for Professional Teaching Standards by modeling other professions like medicine, architecture, law, accounting etc. whose professional boards serve to create standards to increase the professional quality of their members (Darling-Hammond, 2001). The following year led to the birth of National Board for Professional Teaching Standards [NBPTS] with a mission to "establish high and rigorous standards for what accomplished teachers should know and be able to do, and to develop and operate a national, voluntary system to assess and certify teachers who meet these standards" (NBPTS, 1989, p.1).

The idea that each and every child deserves a high quality teacher is not a controversial issue. However, when it comes to defining what constitutes a high quality teacher, it seems that disputes readily arise (Delandshere &

Petrosky, 2004; Goldhaber & Anthony, 2003; King Rice, 2003; National Center for Education Statistics, 1999). That is primarily because teacher quality is a complex topic with no simple definition (Korthagen, 2004; Mitchell, Robinson, Plake, & Knowles, 2001; National Center for Education Statistics, 1999) and the criteria for its definition exhibit variations “from person to person, from one community to another, and from one era to the next” (Mitchell et al., 2001, p.19). The latest teacher education reform movements like Interstate New Teacher Assessment and Support Consortium [INTASC] and National Board for Professional Teaching Standards [NBPTS] revealed their version of teacher quality in their respective teaching standards for beginner and experienced teachers. The characteristics of quality teachers at entry and advanced level are identified in these teaching standards (Delandshere & Arens, 2001). In order to get licensed and certified, teaching performances of beginner and experienced teachers demonstrated in their portfolios are evaluated with respect to their correspondence with these teaching standards (Burroughs, Schwartz & Hendricks-Lee, 2000). Together with National Council for Accreditation of Teacher Education [NCATE] for the regulation of teacher education programs, these standards for initial licensing (INTASC) and advanced certification (NBPTS) constitute a “three-legged stool” (NCTAF, 1996, p.29) that maintains “quality assurance” (Darling-Hammond, 2001, p.13) in the teaching profession. In this research article, my focus will be on the last leg of stool, which is National Board for Professional Teaching Standards.

In the past two decades, the development of new generation of teacher assessments has “given lie to claims that no alternative to conventional teacher tests was available” (Shaker, 2001, p.74). The new generation of standards-based teacher assessments like NBPTS and INTASC differ from their earlier standardized counterparts that primarily depend on multiple choice tests of the basic skills, subject matter knowledge, and pedagogical knowledge of the teachers (Darling-Hammond, 2001). Earlier approaches of teacher assessments are heavily criticized for exhibiting a narrow view of teaching, representing the knowledge base of teaching poorly, failing to reflect teachers’ complex decision making process adequately, and being unable to offer criterion-related validity evidence (Darling-Hammond, 2001). The general approach of conventional teacher tests to measure the subject matter and pedagogical knowledge of teachers in a separate manner by ignoring the context in which teaching takes place is inadequate to achieve that task (Darling-Hammond, 2001). Darling-Hammond (2001) emphasized that problem with standardized tests as “efforts to measure teaching knowledge without reference to the contextual factors and multiple bodies of knowledge that must guide teaching decisions fail to capture the essence of pedagogy” (p.17).

New teacher assessment strategies and the standards that constitute the foundation of these assessments reflect a more complex view of teaching than

their earlier counterparts (Darling-Hammond, 2001; Milanowski, Odden, & Youngs, 1998). National Board Certification [NBC] as an alternative teacher assessment procedure utilizes performance assessment rather than standardized testing in order to distinguish accomplished teachers. Performance assessment has been used in education field for over a period of two decades “with it[s] great promise of fairness and accuracy” (Shaker, 2001, p.74). INTASC (1992) supported this type of teacher assessment procedure because “the complex art of teaching requires performance-based standards and assessment strategies that are capable of capturing teachers’ reasoned judgments and that evaluate what they can actually do in authentic teaching situations” (p.5). The rationale behind performance assessment involve evaluating the performances of the teachers demonstrated in teaching portfolios and open-ended exercises in connection to predetermined standards of what they need to know and be able to do (Schacter, 2001). The assessment of teaching performance has the potential to capture the critical interactions between teacher and students, and a better image of the specific context in which these interactions take place (Darling-Hammond, 2001).

One of the unique aspects of the performance assessment of NBC is that it evaluates not only subject matter and pedagogical knowledge of teachers, but also the actual demonstrations of the knowledge and skills of the teachers in their daily teaching practices. In order to achieve this, the assessment process relies on two major activities: a) assessment center exercises to evaluate the content knowledge of teachers and b) portfolio entries to examine the actual teaching practices of teachers (NBPTS, 2003b). Assessment center exercises consist of six 30-minute computer-based activities, each of which has been designed to assess the content knowledge of the candidate teachers in their specific area of certification (NBPTS, 2003a). In addition to completing these content assessment prompts, candidate teachers are required to submit a portfolio that contains four entries, each of which provides direct evidence of their use of the advanced teaching standards of NBC in their classrooms (NBPTS, 2003a). Whereas three entries focus on classroom practices of the teachers accompanied by two videotapes of classroom teaching and student work samples, one entry documents their accomplishments outside of their classrooms that reflect their interactions with the colleagues, families, and larger community (NBPTS, 2003a). The portfolio artifacts are supported by analytical, descriptive, and reflective explanations (NBPTS, 2003a). Once all these portfolio artifacts are submitted to NBPTS, they are evaluated by two independent assessors to determine whether the applicant teacher demonstrates sufficient evidence that her/his teaching aligns with the advanced teaching standards of NBC. The assessors are selected from qualified teachers who demonstrate a good understanding of the teaching standards and scoring guidelines and given an intensive training on how to score portfolio entries.

With all the money and efforts spent on NBC, this new generation of teacher assessment is gaining more recognition by larger education community (Darling-Hammond, 2001; Kelley & Kimball, 2001). One of the distinctive characteristics of NBC process is that it not only assesses the classroom practices of teachers against advanced teaching standards but also promotes teacher learning and improvement through teaching portfolios and open-ended exercises, which is a new dimension not envisioned by earlier generations of teacher tests (Darling-Hammond, 2001). According to NBPTS (2003a), “most teacher candidates find that the yearlong reflection and analysis process that National Board Certification candidacy entails is one of the most rewarding and meaningful experiences of their professional lives” (p.13). Even those of the teachers who fail the assessment process of NBC agree on the value of their learning from their certification experiences (Vandevoort, Amrein-Beardsley, & Berliner, 2004). Indeed, one who studies on the subject can easily find many testimonies of the teachers that express the positive contribution of the performance assessment process to their professional development. While these testimonies indicate the value of the certification experience for teachers, they essentially tell us very little in terms of our understanding of their professional development (Darling-Hammond, 1999a; Lustick, 2002). The education literature appears to be insufficient in presenting an accurate picture of NBC in the professional development of teachers (Goldhaber, Perry, & Anthony, 2003; Keiffer-Barone, Mulvaney, Hillman, & Parker, 1999; Lustick & Sykes, 2006). In other words, the field is somewhat uninformed in terms of how NBC serves as a professional development experience for teachers, what teachers learn from their certification experiences, and how they benefit from what they learn. With science teachers particularly, there is less likelihood of finding a study that investigated their learning experiences from NBC assessment process. Majority of the articles written on the subject made no distinction among the experiences of the teachers from different disciplines. Few, if any, studies looked at teacher learning from NBC assessment process with respect to subject-specific focus. Research studies conducted on specific subjects might help education community develop a better understanding of subject-specific learning experiences of the teachers from the certification process. Furthermore, several of the existing studies on the subject are criticized for being subject to possible bias due to having a connection with NBPTS (Goldhaber et al., 2003). Therefore, NBPTS seeks more evidence from research studies conducted by independent researchers in order to strengthen its arguments that NBC determines accomplished teachers successfully and contributes to their professional development.

## **METHODOLOGY AND METHODS**

Advanced science teaching standards of NBC have been developed in parallel to the ideas promoted in recent science education reform documents. This means that NBPTS like several of its counterparts supports the major themes of science education reform documents in its advanced teaching standards for science teachers. Accordingly, teachers who undergo the performance assessment process of NBC are expected to become more prone to support science education reform ideas. Does NBC really have the power to awaken such consciousness of reform ideas in science teachers? If not, what role does NBC play in the professional development of science teachers? And could we say that the teaching notions and the practices of those of the science teachers who successfully passed the performance assessment of NBC are necessarily aligned with the central ideas of science education reform efforts? In this article, I sought an answer to those questions through basing my arguments on the perspectives of four experienced science teachers who received their advanced teaching certificates with NBC in various years.

In response to the limited number of research studies that investigated the perspectives of science teachers on the subject, this naturalistic study, in a most general sense, focused on the lived experiences of science teachers with the performance assessment process of NBC. The following sub-questions listed under the main question guided the research process:

What does undergoing NBC assessment process mean for science teachers?

1. How do science teachers see the role of NBC in their professional development?
2. What learning experiences do science teachers identify with NBC assessment process?
3. Does NBC experience create a higher affiliation with science education reform ideas?

In this article, I adopted a social constructionist stance that postulates that meaning comes into existence by the interactions of individuals with the objects and others in a socially and culturally interwoven world (Crotty, 1998). In other words, social constructionism informed this study epistemologically. This study was conducted within the borders of interpretivistic research paradigm due to the fact that developing a comprehensive understanding of the constructed meanings of the participant science teachers involved interpreting what they said about their subjective experiences. According to Gadamer (1989), “Understanding occurs in interpreting....[and] all understanding is interpretation” (p.389), and it is the only way for a deeper understanding of people’s interior worlds (Wilber, 1997).

In an attempt to grasp an understanding of multiple perspectives held by participant science teachers, I employed the methodology of the naturalistic (constructivist) inquiry (Guba & Lincoln, 1989) in the research process. In order to delve into the meanings of the teachers, the naturalistic inquiry methodology employs hermeneutic dialectic circle:

The hermeneutic aspect consists in depicting individual constructions as accurately as possible, while the dialectic aspect consists of comparing and contrasting these existing individual (including the inquirer's) constructions so that each respondent must confront the constructions of others and come to terms with them. (Guba, 1990, p.26)

The process of hermeneutic dialectic circle involves reaching to the most informed construction negotiated by the research participants (Guba & Lincoln, 1989). In the following sections, I will present more details about the use of hermeneutic dialectic circle in the study.

### **Participant Teachers**

In a period of six months, I worked with four experienced science teachers certified by NBPTS. In other words, I wrote this article based on the cases of four science teachers whose accomplished teaching practices of science were recognized by NBPTS. I selected these teachers for the study purposefully in an effort to create a more dynamic negotiation process among the participant teachers with different perspectives. After my initial contact with seven science teachers who agreed to participate in the study, I decided to continue my research with four of them because four were more manageable for the purposes of a case study design that involved in-depth investigation of the selected subjects. Based on my preliminary evaluation, the selected teachers for the study appeared to be better informants in comparison to the eliminated three. For the sake of representing different views, I wanted to include both group of teachers, those of who appeared to support the ideas promoted in science education reform documents and those of who exhibited some level of resistance to the ideas advocated in science education reform documents, in the study. The purposeful selection of the research participants in the study strengthened my arguments due to comparing and contrasting of the various perspectives.

I used the following pseudonyms for the participant teachers in order to protect their confidentialities: Jennifer, Patricia, Martha, and Mary. Whereas Jennifer was a high school chemistry teacher, other three of the teachers were teaching science in a middle school. In comparison to Jennifer and Patricia's more than 25 years of teaching experience, Martha and Mary had been teaching science for the past 12 years. Both Jennifer and Patricia passed the assessment process of NBC in 2003. Martha and Mary achieved their advanced teaching certificates in 1999 and 2000 respectively. Except Martha,



the participant teachers had master's degrees. Martha had a double major in biology and science education. Jennifer completed her undergraduate degree in biology and her master's degree in biochemistry. Patricia held a bachelor's degree in elementary education and a master's degree in science education. Mary graduated from the university with an undergraduate degree in geology and a master's degree in science education.

The public schools in which those participant teachers had been working were dominated by a minority student population. However, in comparison to Jennifer and Patricia, Martha and Mary were serving to a more challenging group of students. Due to Jennifer and Patricia's teaching responsibilities in International Baccalaureate (IB) programs, they were addressing to a select group of student body even if their schools were populated with minority students. The students in IB program had been selected based on their scores on standardized tests. The curriculum followed in IB programs tended to be more content-driven than the integrated science taught by Martha and Mary in their middle school.

### **Data Collection Process**

I used qualitative data collection methods, namely classroom observations, in-depth teacher interviews, and document analyses of teacher portfolios, in my study because as a qualitative inquirer I believe that I "can get closer to...[participant teachers'] perspective[s] through detailed interviewing and observation" (Denzin & Lincoln, 2000, p.10). Qualitative data collection methods, according to Patton (1990), "permit the...researcher to study selected issues in depth and detail; the fact that data collection is not constrained by predetermined categories of analysis contributes to the depth and detail of qualitative data" (p.165). Qualitative studies provide rich information about the subjects being studied because "words, especially organized into incidents or stories, have a concrete, vivid, meaningful flavor that often prove far more convincing to a reader than pages of summarized numbers" (Miles & Huberman, 1994, p.1). Indeed, the qualitative methods employed in this research study served successfully in providing an in-depth account of the experiences of participant science teachers with the performance assessment process of NBC.

I visited the classrooms of the participant teachers several times. Those visits allowed me to learn more about teachers, their students, their classroom contexts, their teaching practices of science. Gaining more insights into the classroom contexts of the teachers gave me more confidence in making assertions about the teachers. In a sense, experiencing the specific contexts of the teachers was supportive to my understanding of their thoughts in their interview responses. My classroom visits were also crucial in terms of keeping in touch with teachers. Having more interactions with the teachers was needed

to build a rapport with them and to get into their sincere thoughts. Having conversations with the teachers in classroom visits were helpful for clarifying some of their responses in formal interviews.

In the interviewing process, I followed hermeneutic dialectic circle. The process of hermeneutic dialectic circle started by conducting an in-depth interview with one of the respondent teachers. This initial interview practiced with open ended questions to keep the interviewee free in expressing her views with her own terms generated a construction between me as the researcher and respondent teacher. I conducted the second interview with another teacher by allowing her the same freedom of expression as was the first interviewee. However, I additionally introduced some of the themes emerged from the first interview to the second interviewee and allowed the second interviewee to comment on these initial themes. This ensured that the interview with the second interviewee generated information not only about herself but also a critique of the first interviewee's construction. Likewise, subsequent teacher interviews in the hermeneutic circle proceeded by introducing the earlier construction back into next interview process. The circular interviewing movement in the study continued with all participant teachers. As the participant teachers criticized the preceding interviewee's construction, a joint construction that exhibited a consensus among all responded teachers began to emerge. This joint construction could be considered as "the most informed and sophisticated construction that it is possible to develop in this context, at this time, with these respondents" (Guba & Lincoln, 1989, p.179). In addition to the three formal interviews, I conducted several informal interviews with each participant teacher in my visits to her classroom.

The portfolios submitted by the teachers to the assessment center of NBPTS served as an important data resource in the study. The participant teachers in their portfolios provided a reflective analysis of their teaching practices of science. These reflections contained valuable information to uncover the general approaches of the teachers to the ideas promoted in science education reform documents.

### **Data Analysis**

According to Guba and Lincoln (1989), data analysis is a continuous process in naturalistic inquiry methodology. The systematic interviewing procedure in the hermeneutic dialectic circle already compelled me to engage with the interview data earlier because I needed to convey the central ideas of previous interviewees to the next interview process. Before starting the analysis of interviews at the end of data collection process, I had already made some preliminary assertions about the teachers in the study.

In analyzing the available data, I followed the data analysis method of Miles and Huberman (1994). They explained the analysis process of qualitative data in three stages: data reduction, data display, and conclusion drawing.

In the first stage of data analysis, I placed electronic copies of the available data artifacts of the teachers such as field notes from classroom visits, interview transcripts, and written commentaries from teacher portfolios into the folders assigned for each teacher. Although this process put the available data in a more accessible form, it was no help in reducing the volume of the data into more manageable format. Afterwards, I run a qualitative data analysis software to code each data artifact in the folders. I used major codes and sub-codes in order to allow the data analysis software to list the relevant codes together. The coding process tremendously reduced the amount of usable data because it gave me the opportunity to review all available data artifacts and to eliminate some of the irrelevant data.

In the second stage of the analysis, I created printed reports for easy display of the coded data. The data analysis software had the capability of producing reports sorted either by case name or code name. I created data reports in both forms. Creating reports sorted by code name placed all relevant teacher information under their corresponding codes. This gave me the opportunity to see the relevant quotes from all teachers under their respective data codes. I printed the reports produced by the data analysis software. Having printed copies of the data reports was helpful to have a visual access to all teacher data at the same time. And whenever I needed to see a specific quote from a teacher in its written context, the software displayed the highlighted quote in the whole document.

In the final stage of the data analysis, I drew my conclusions from the coded data. The printed data reports displayed the extracted quotes of all teachers under their relevant data codes. This made comparing and contrasting of the teacher cases easier. My careful analyses of teacher responses in the same coding categories resulted in developing conceptual themes. Based on those key conceptual themes, I created my assertions. In order to support the assertions, I made the arguments supported with the relevant evidences emerged from the analysis of the teacher data.

## **STUDY RESULTS**

Based on the cross case analysis of participant teachers, I made some assertions about them. In the following sections, I will present my assertions accompanied by the relevant evidences to support them.

## Views of Reform Ideas

I start this section by presenting my assertion about the general attitudes of the teachers towards the ideas promoted in science education reform documents.

***Assertion-1:*** *Science teachers certified by NBPTS are not equally open to the ideas advocated in science education reform documents.*

All four of the teachers in the study had many years of teaching experience. In addition to K-12 teaching experience, Jennifer had worked at a local community college as an adjunct chemistry instructor for several years. In comparison to Martha and Mary, Jennifer and Patricia had higher expectations from their students due to their teaching work with a select group of students in IB programs. With many years of teaching experience, participant teachers had been able to establish their ways of teaching science, which were all successful on their own respect. They documented their accomplished teaching capabilities in the portfolio assessment process of NBC. None built her teaching practices of science on textbooks. Rather, they all used variety of resources in their teaching practices of science.

However, their views of teaching and learning science were not equally open to science education reform ideas. In comparison to Martha and Mary, Jennifer and Patricia kept a noticeable distance from the ideas promoted by academic field of education. They visualized science teachers as the content experts. To them, the major role of the teacher involved “getting across” the information to students in a best comprehensible manner. They believed that the context in which they taught necessitated using more conventional teaching strategies. For example, the following excerpt from one of Jennifer’s interview indicated such argument:

I still believe I am a traditional teacher because I feel like higher level classes demand it. I think the higher you go, the more traditional you can be with this. I think low level classes you can do all of these stuff [ideas advocated in teaching standards of NBC] to help them understand but the high level students, they just need to get the information in a fast way. (Interview, Jennifer)

Jennifer believed that the role of teacher involved delivering the available knowledge to students in a more direct way. Similarly, in her following interview response, Patricia considered student investigation of the scientific ideas as a highly time consuming process for her students:

You can’t let students explore basic information without it taking way too long in lots of cases. A lot of times, you have to tell it to them anything in lecture kind of format, and then have them experiment with it so they can see how you said applied to something else. (Interview, Patricia)

In a more traditional sense, Patricia conceptualized the laboratory experiences of students as a platform for applying their knowledge of science rather than learning new scientific information.

Both teachers, namely Jennifer and Patricia, expressed their doubts about the potential value of educational theories. In the following interview response of Jennifer, it was possible to observe this attitude:

I think I am a little cynical about the educational theories. I feel like a lot of times the professors have these glorified ideas of what we can really do in a school. When it comes down to it, can I just make my students sit down in their desk? And teach them which side of the arrow the reactants are on. I feel like, yes, I am cynical about it. (Interview, Jennifer)

Like Jennifer, Patricia maintained a distance from the ideas of academic field of education. She found educational theories promoted in the reform documents impractical for actual classroom conditions:

It has been a good 8 or 9 years since I have done any serious reading in science education of philosophy and theory. A lot of the stuff is just impractical in the classroom. It is nice pretty thoughts but... (Interview, Patricia)

In her interview excerpt above, Patricia indicated her lack of confidence in the ideas proposed by academic field of education.

Unlike Jennifer and Patricia, both Martha and Mary exhibited a reform-oriented science teacher portrait. In other words, they supported the reform ideas of science education community. For instance, in the following interview response, Mary expressed her support to the ideas included in the teaching standards of NBC:

Your teaching has to be aligned with the standards. Otherwise, you wouldn't be certified. If you don't buy into that, then this is waste of your time. But I happen to believe in those standards are the direction where we need to go. I just wish I was better at it. (Interview, Mary)

In addition to supporting the vision of science education standards, Mary indicated her willingness to improve herself in enacting the standards in her classroom.

Martha and Mary identified their major role in their classrooms as the facilitator of student learning of science. According to Martha, facilitating the learning of students involved engaging them into appropriate classroom experiences to allow them to build their own understanding of scientific ideas:

I see myself as a facilitator. I like to give students experiences and let them come up with some of their own information. And then we discuss it. So I try to do as much activities and projects as I can to give my students the opportunities to build their own information. (Interview, Martha)

Martha conceptualized student investigations as an intrinsic aspect of science classes. In order for students to be able to generate meaning from their classroom experiences, Martha knew the importance of providing autonomy to them in their classroom investigations. In a similar fashion, Mary considered hands-on activities as an inseparable element of teaching science:

I just find it difficult to teach a concept that the students can't get their hands on it. I just think it makes more sense and my job is to help them make those connections and wrap it up well, which I don't always do very well. (Interview, Mary)

From Mary's interview excerpt above, it would be possible to suggest that activity-oriented nature of classroom experiences constituted the essence of her philosophy of teaching science.

Based on my observations of the participant teachers, Jennifer and Patricia appeared to depend more on their overhead projector, which was located in front of their classrooms, in their teaching practices of science. Many times, they instructed their students in a traditional format from a chair in front of the overhead projector. Martha and Mary's use of the projectors was more limited in their presentation of science topics. They seemed to situate their teaching of science more on science activities. Therefore, the frequency of direct instruction used by Martha and Mary with their students was relatively less than Jennifer and Patricia. This meant that my observations of the teaching practices of the participant teachers were in compliance with their interview responses.

In a nutshell, the cross case analysis of the participant teachers indicated that they were not necessarily prone to supporting the reform ideas advocated in science education community. Unlike Martha and Mary, the cases of Jennifer and Patricia uncovered their resistance to accept the major premises of the science education reform ideas.

### **Affirmational Role of NBC Process**

In this section of the paper, I present the views of the participant teachers on the role of NBC performance assessment process in their professional development as science teachers. The section starts with the following assertion and continues with the presentation of the perspectives of the participant teachers.

***Assertion-2:** Undergoing NBC assessment process strengthened the existing views of science teachers rather than opening new avenues in their teaching practices of science.*

The ideas presented in this study represent the science teachers who successfully passed the assessment process of NBC. Except Mary, the teachers in the study achieved their advanced teaching certificates with NBC in their first attempts. In Mary's case, she was not able to pass the assessment in her first try. Therefore, she got a passing score after resubmitting an improved version of one of the sections in her portfolio for a second consideration.

The cross case analyses of the teachers in the study indicated that they were in agreement with one another about the affirmational role of NBC portfolio assessment process in their professional development. As an overall reflection of their NBC experiences as a professional development activity, they brought the affirmational role of NBC to the fore in several instances. For example, in her following interview response, Jennifer discussed the role of NBC in verifying the quality of her teaching practices of science:

Whenever you have an outside validation, it helps you to feel good. You don't always get that from your students and nobody else really sees you teach so you never know really. So it is a little bit hard to judge. Just because you feel good about your teaching doesn't necessarily mean that it was good. (Interview, Jennifer)

For Jennifer, passing the performance assessment of NBC meant to have an outside validation of good teaching, which was something hard to obtain from inside of her classroom. Like Jennifer, Patricia identified the place of NBC in her professional development as an affirmation that her teaching practices of science were quality enough to pass the rigorous assessment procedure of NBC: "I learned that some of the stuff that I have been doing was really the right stuff. It was an affirmation of what I am doing is the correct stuff" (Interview, Patricia). In her experience with NBC assessment process, she realized that she was already performing her role as a science teacher in her classes with great success. Martha felt that her teaching practices of science found an endorsement in a nationally recognized prestigious group of educators. The sense of affirmation gained from this prestigious group outweighed any of her new learning experiences:

For me, I think it really kind of affirmed what I thought about teaching. And I did learn some new things but I really think that it affirmed what I already knew and things that I was already doing. It wasn't such a big stretch for me because I felt like I was doing a lot of those things. (Interview, Martha)

From Martha's expressions above, it was possible to suggest that undergoing the assessment process of NBC was more of documenting her good teaching skills rather than struggling with new ideas in teaching of science. For Mary, being certified by NBPTS meant joining to a prestigious group of teachers with accomplished teaching practices of science. Like her husband's professional geologist license, obtaining her advanced teaching certificate

ensured that she had the potential to perform her job with the maximum capabilities. In that sense, NBC was a validation of her good teaching capabilities in science:

I mean more validation. I knew I was doing good things. I knew my students were pretty happy and they enjoyed my classes. On the professional level, this was a pretty prestigious group and I guess I looked at it sort of like my husband. He is a geologist. And when he decided to get his professional geologist license, it is a validation. It says, "Yes! You know how to do this. Yes! You are good at it." I kind of looked at it that way. (Interview, Mary)

Mary was confident that she had been a successful science teacher. However, she considered her advanced teaching certificate as a formal documentation of her good teaching skills.

A comparative analysis of the responses of the teachers in the study indicated that undergoing the assessment process of NBC played an affirmational role in their professional development. This meant that obtaining the advanced teaching certificates proved that science teaching practices of the teachers were accomplished due to their alignment with the nationally recognized teaching standards of NBC. The certification experience strengthened the existing notions of the participant teachers in teaching of science. In other words, their exposure to the performance assessment process of NBC constituted a medium on which they found support for their existing ideas in teaching of science. For instance, Jennifer always identified herself as a traditional teacher, yet her individual experience with NBC did not weaken her traditional notions of teaching science. Likewise, Patricia completed the assessment process of NBC with a sharpened confidence in her existing notions of teaching science. Her accomplishment made her feel that she was a better science teacher than she thought she was. It appeared that the parallel ideas of science education reform documents embedded in the advanced teaching standards of NBC had a very limited influence on the teachers. Their involvement in NBC did not result in integrating more reform-oriented ideas in their teaching practices of science. This suggested that science teachers who underwent the assessment process of NBC did not necessarily develop a higher affiliation with the ideas promoted in science education reform documents.

Based on the supportive evidence presented in this section, I make the argument that affirmation of teaching capabilities through NBC strengthens the existing notions of science teachers who hold traditional ideas of teaching. This seems to work to some extent against rather than towards the promotion of reform-oriented teaching practices of science. That is primarily because traditional science teachers who find an endorsement for their teaching in the certification process gain more confidence in their teaching capabilities of science. However, their elevated confidence levels might sharpen their further



resistance towards the science reform ideas. At least, it was the case with the science teachers in this study.

### **Reflective Nature of NBC Experience**

The main focus of this section of the paper is to display the specific learning experiences of the participant teachers from their involvement in the assessment process of NBC. I present the perspectives of the teachers in the study to reinforce the assertion below.

***Assertion-3:*** *As a result of experiencing the performance assessment of NBC, teachers developed an awareness of the reflective practice in becoming effective science teachers.*

In the process of preparing the teaching portfolios to be submitted to NBPTS, the participant teachers underwent a reflective examination of their teaching practices of science. Despite many years of teaching experience, they had never been exposed to a systematic and persistent scrutinization of their views and ways of teaching science. Especially for Jennifer, reflecting on her teaching with an educational perspective was a new experience because she had started her teaching career with no formal teacher education:

One of the challenging things was explaining why you do things. And I haven't really given too much thought about why I do things. It is like in my heart I just wanted my students to learn it. So I was always thinking about the children and helping them to learn it. But I haven't ever thought "Well! I do this because...This person is like this." I had those reasons but I never had to verbalize them. (Interview, Jennifer)

In the certification process, Jennifer had the opportunity to reflect on her teaching. Undergoing the reflective assessment process made her more aware of the specific reasons for her actions in her teaching practices of science. As Jennifer became more cognizant of the dynamics of her teaching, she felt more confident about uncovering the nuances in her teaching for explaining them to inexperienced teachers in her school. In my classroom visits, I observed that Patricia had a busy teaching schedule. Under such circumstances, Patricia did not have much time and energy to reflect upon her teaching practices of science. Besides, everyday teaching had turned into a routine job for Patricia after many years of experience. At this point, the reflective nature of NBC process promised a good opportunity for Patricia to reflect on her teaching: "It forced me to take time to think about what I did because I usually get so busy in doing the things. I don't really take time to think about what I am doing the best that I could" (Interview, Patricia). Despite her limited learning experiences from NBC, Martha found the certification process helpful in promoting the reflective practice in teaching. As a result of NBC experience,

Martha developed a higher cognition of practicing more reflections on her teaching actions:

I experienced nothing really specific but I think just the reflection was really good. It was just good because they require you to go back and look at what you have done in your teaching. I think I was doing it before but I think I just started doing it a little bit more afterwards. (Interview, Martha)

Like other teachers in the study, Mary recognized the importance of the reflective practice in effective teaching of science. After her completion of the portfolio assessment process of NBC, maintaining the same level of reflection was not possible for Mary. However, NBC experience helped her development as a reflective science teacher: “I got better about reflecting on my teaching because the questions in the portfolio make you focus particular things in your reflections. I think I got a little better at that” (Interview, Mary).

The cross case analyses of the teachers in the study indicated that they experienced a reflective examination of their teaching in the performance assessment process of NBC. This led the teachers to recognize the important place of the reflective practice in effective teaching of science. As a result of reflecting on their teaching, they discovered some aspects of their teaching that needed further improvement. For instance, reflecting on her teaching of science taught Jennifer to pose more questions to her students:

It reinforces you to question your students more so that you see what their understanding is. I ask more questions to the students to see what their thinking is like because I didn't know this is what they were thinking until I asked them more. (Interview, Jennifer)

In a similar fashion, Patricia noticed the need for developing better questioning techniques in order to increase the effectiveness of her teaching. Analyzing the video recordings of her teaching allowed her to capture the bad habits that she developed in many years of her teaching experience: “When you see yourself on videotapes, you can look at yourself through new eyes. You know better but it just reminds you of the things that you get into habit of doing” (Interview, Patricia). Martha was not able to identify an influential learning experience from her reflective journey in NBC process: “It wasn't such a big stretch for me because I felt like I was already doing a lot of those things” (Interview, Martha). This suggested that NBC process for Martha did not go beyond documenting her teaching capabilities of science that lacked opening new avenues in her teaching practices of science. In Mary's case, the reflective examination of her teaching encouraged her to do better informed and long term plans in her teaching actions: “I am more conscious of when I plan although I sometimes find myself slipping back all the habits too. But I think I became a better planner. I am doing more long term planning than I

used to” (Interview, Mary). However, Mary was struggling to maintain some level of consistency in her teaching plans.

In a nutshell, the participant teachers agreed that pursuing their advanced teaching certificates put them into a reflective position on their views and practices of teaching science. Although all teachers in the study appeared to recognize the essential role of reflective practice in effective teaching of science, it would be difficult to suggest that they continued reflecting on their teaching practices of science in a similar way they did in the assessment process of NBC. In other words, the portfolio assessment process of NBC created a higher awareness of the reflective practice, yet providing a readily available answer to the question of how consistently the teachers adopted it in their everyday teaching practices of science after their NBC experience was beyond the scope of this research article.

## **DISCUSSIONS AND IMPLICATIONS**

The critical role of teachers is undisputable in the success of any education reform movement (National Research Council, 1996). That is primarily because teachers are the sole stakeholders of the enactment of reform ideas at the micro level of classroom. That is why having quality science teachers with the capabilities of integrating the ideas promoted in science education reform documents into their teaching practices of science is essential for turning the reform ideals into a reality. NBC as a new generation of teacher assessment procedure not only determines the quality science teachers but also helps them become better teachers (Darling-Hammond, 2001; Lustick, 2002; Lustick & Sykes, 2006; Vandevort, Amrein-Beardsley, & Berliner, 2004). As teachers go through the reflective professional development process of NBC, they attach a special meaning to their certification experiences. Undergoing the rigorous assessment process of NBC is described by many teachers as a rewarding professional development experience (Lustick & Sykes, 2006). However, the science teachers in this study identified their involvement in the assessment process of NBC not as a deeply influential professional development experience. For participant teachers, their experiences with the performance assessment process of NBC played an affirmational rather than a transformational role in their professional development. This meant that achieving their advanced teaching certificates strengthened their existing notions of teaching science. In other words, they completed NBC assessment process with an elevated confidence in their existing teaching practices of science. Although this finding stood somewhat in opposition to the majority of research studies that suggested the important place of NBC in the professional development of teachers, some scholars (e.g. Chittenden & Jones, 1997; Lustick, 2002) reported the affirmational role of NBC in professional development of the teachers.

NBPTS introduced reflective practice as one of the most important outcomes of NBC in professional development of teachers. The assessment process of NBC allowed the participant science teachers to reflect on their teaching. Whereas the reflective nature of NBC process was successful in providing the support to strengthen their own identities as strong teachers, it failed to introduce them to the challenge of questioning their views of teaching science deeply under the light of science education reform ideas. Although the certification experiences did not create authentic changes in their views and practices of teaching science, systematic and persistent analysis of their teaching helped them to better understand the underpinning psychological reasons of their teaching actions. Never before in their professional teaching careers had they verbalized the dynamics of their teaching practices of science. They had always their educational reasons in their minds, yet verbalizing their thoughts helped them clarify their ideas better. Undergoing the assessment process of NBC did not result in developing a more complex and sophisticated view of teaching science but reminded the important place of reflection in improving the quality of their teaching practices of science. However, this did not necessarily mean that they developed a habitual behavior of reflection on their everyday teaching practices of science.

These conclusions need to be interpreted carefully because the affirmational experiences of these participant teachers in the assessment process of NBC do not necessarily mean that not a single teacher undergoes a transformational experience in their teaching practices of science as a result of pursuing NBC. In some cases, teachers who fail in their attempt to get their advanced teaching certificate report the high value of NBC assessment process in their professional development (Lustick & Sykes, 2006; Vandevoort & Berliner, 2004). All teachers in the study had started their NBC journey with many years of teaching experiences. Although they were not equally open to the ideas promoted in science education reform documents, none of them supported teaching science directly from textbooks in a most traditional manner. Rather, they used variety of different resources and activities in their science classes. With many years of teaching experience, they managed to perform their science teaching tasks successfully. They had the capabilities of aligning their teaching practices of science to advanced teaching standards of NBC with only slight modifications (Lustick, 2002). Except one, they had achieved their advanced teaching certificates with NBC in their first attempts. Those slight modifications made by participant teachers to satisfy the teaching standards of NBC were far from creating a transformational effect on their notions and ways of teaching science. The teachers who spend more effort and make significant changes in their teaching practices might have a more transformational experience in their teaching philosophies of science.

The ultimate goal of professional development experiences of teachers is to create a change in their views and ways of teaching science. However,

change is a complex process that involves taking into account the individual factors (National Research Council, 2000). Every individual teacher goes through the process of professional development with their unique experiences. And they “are not equally open to, capable of, or prepared for change” (Beck & Cowan, 1996, p.76). Beck and Cowan identified people with respect to their potentials for change on a continuum from “open” to “arrested” to “closed.” Some teachers start their professional development journeys with more resistance to change. This implies that undergoing a professional development experience does not necessarily produce same levels of change in teachers. Depending on their potentials for change, they might come out of their professional development experiences with different professional gains. Although the reflective process of NBC allowed the participant teachers in this study to examine their teaching practices of science, it was not capable of leading the teachers to embrace new views of teaching science. Undergoing a radical change by these experienced teachers was not an easy endeavor because they had developed firm beliefs in their ways of teaching through many years of classroom teaching experiences.

In summary, although advanced science teaching standards of NBC support the parallel ideas of science education reform documents, the findings of this research study suggest that science teachers who achieve their advanced teaching certificates with NBC do not necessarily support the central tenets of science education reform ideas. The specific cases in this study indicate that teachers who have the capabilities of meeting the teaching standards of NBC with slight adjustments to their teaching practices of science may complete the requirements of NBC portfolio assessment procedure successfully even if they keep a distance from the reform ideas. Undergoing the assessment process of NBC does not necessarily create a higher affiliation with science education reform ideas. On the contrary, teachers who support more traditional views of teaching science may come out of NBC assessment process with a sharpened confidence in their existing conventional notions of teaching science. This implies that acknowledging all science teachers certified by NBPTS as reform-minded teachers would be misleading. This result also implies that successful completion of the performance assessment process of NBC does not necessarily result in embracing more reform ideas in their everyday teaching practices. Teachers’ sharpened confidence in their existing traditional views of teaching science as a result of their successful completion of NBC assessment process might even be considered as an inhibiting factor in their further development as reform-oriented science teachers.

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