



## VALUE SYSTEMS: A BETTER WAY TO UNDERSTAND SCIENCE TEACHERS' BELIEFS AND PRACTICES?

### DEĞER SİSTEMLERİ: FEN ÖĞRETMENLERİNİN EĞİTİME YÖNELİK İNANÇLARINI VE UYGULAMALARINI DAHA İYİ ANLAMANNIN YOLU OLABİLİR Mİ?

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**ABSTRACT:** Since science teachers are an important factor in implementing educational reforms in science education, there are many studies in the literature about their beliefs and practices. Most of these studies investigate science teachers' certain beliefs about science and education in isolation. This study suggests that it is more useful to investigate science teachers' beliefs and practices from a perspective of *values* and *value systems*. An interpretive-qualitative study that investigated four science teachers' values in relation to their beliefs and teaching practices is reported here. In the discussion, it is suggested that determining science teacher's value priorities provide a better understanding of their beliefs and practices which may offer more informed ways of working with teachers to enhance their development.

**Key words:** science education, science teacher education, values, value systems

**ÖZET:** Fen öğretmenleri fen eğitiminde yapılan reform çalışmalarında önemli bir faktör olduklarından, literatürde onların eğitime yönelik inançları ve sınıf içi uygulamaları ile ilgili birçok çalışma mevcuttur. Bu çalışmaların çoğu, fen öğretmenlerinin fen ve eğitim ile ilgili belli inançlarını bağımsız olarak incelemektedir. Bu çalışmada ise fen öğretmenlerinin eğitime yönelik inançlarının ve sınıf içi uygulamalarının *değerler ve değer sistemleri* perspektifi ile incelenmesinin daha yararlı olacağı önerilmektedir. Dört fen öğretmenin değer sistemlerinin, eğitim ile ilgili inançları ve sınıf içi uygulamaları ile olan ilişkisi yorumlayıcı-nitel bir çalışma ile incelenmiştir. Tartışma bölümünde, fen öğretmenlerinin değer önceliklerinin belirlenmesinin onların eğitim ile ilgili inançlarının ve eğitim-öğretim sürecindeki tercihlerinin daha iyi anlaşılmasını sağlayacağı ve onların gelişimine bu sayede yardımcı olacağı önerilmiştir.

**Anahtar sözcükler:** fen eğitimi, fen öğretmeni eğitimi, değerler, değer sistemleri

## 1. INTRODUCTION

Teachers are the main agent of change in educational reforms (Black & Wiliam, 1998; Bybee, 1993; Cochran-Smith & Zeichner, 2005; Darling-Hammond & Bransford, 2005; Tobin, Tippins & Gallard, 1994). Woodbury & Gess-Newsome, (2002) argue that teachers should be at the center of focus if reform efforts in education are to achieve their goals. Beliefs influence the actions of teachers and if teachers are the main driving force for change, the nature of their beliefs must be understood (Blake, 2002; Bryan, 2003; Bybee, 1993; Kagan, 1992; Nespor, 1987; Pajares, 1992; and Tobin, Tippins & Gallard, 1994). Related research in science education study teacher beliefs in relation to a particular subject. However, investigating teacher beliefs from a wider perspective could provide a better understanding of their beliefs and practices (Pajares' 1992). The concept of values may provide such perspective. There are publications that describe, contrast or attempt to modify student, teacher or scientific values in the science education literature (Akerson, Buzzelli and Donnelly, 2008; Bledsoe and Morris, 1964; Grace and Ratcliffe, 2002; Huston, 1975; Lacey, 1999; Kuhn, 1973; Power and Tisher, 1973; Quinn, 1976; Stahl, 1979; Thelen, 1987). There are very few, if any, that investigate science teachers' beliefs from a "values perspective." Rokeach (1973) define values as:

A *value* is an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence. A *value system* is an enduring organization of beliefs concerning preferable modes of conduct or end-states of existence along a continuum of relative importance. (p. 5)

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Values are certain type of fundamental beliefs held by individuals or societies. These fundamental beliefs provide guidance to cope with the perceived world for both individuals and societies. Some beliefs are more important than others, so there has to be a priority assigned to each value; and the organization of values into a consistent structure based on the assigned priorities would form the value system, again both at the individual and social level. According to Rokeach (1973), when a new value is learned, it is somehow integrated into the value system where it takes its place among other values based on its assigned priority. In time, some values may loose or gain importance and hence their priority in the value system may change. However, change in value systems do not happen suddenly. Rokeach argues that a value system “is stable enough to reflect the fact of sameness and continuity of a unique personality within a given culture and society, yet unstable enough to permit rearrangements of value priorities as a result of changes in culture, society, and personal experience (p. 11).” Value systems influence individuals’ choices, beliefs and attitudes because of their significance to meaning making and coping with the world. Knowing someone’s values even allow prediction of many of his/her opinions and attitudes (Inlow, 1972). According to Bem (1970):

Values are important because of their centrality to other beliefs and attitudes. ... many particular attitudes and beliefs derive from them. This largely accounts for the fact that the same clusters of opinions appear so frequently in our society. Labels like “liberal” and “conservative” usually enable us to predict many of an individual’s attitudes because these two terms refer to broad underlying values which are shared by large segments of the population (p. 17).

Values determine positions on social issues, political or religious ideology, how people present themselves to others, how people evaluate and judge, how people compare themselves with others on issues like morality and competence (Lakoff, 2002). They clarify which beliefs, attitudes, values, and actions of others are worth challenging, protesting, and arguing about and finally they tell us how to rationalize our beliefs, attitudes, and actions that would otherwise be personally or socially unacceptable. Values do not act alone when influencing human attitudes and behavior. As cited in Rokeach (1973), Williams (1968) says:

It is the rare and limiting case. If and when a person’s behavior is guided over a considerable period of time by one and only one value... More often particular acts or sequences of acts are steered by multiple and changing clusters of values. (p. 287)

Since values are central constructs, it makes sense to study teachers in relation to values which may provide a better understanding of their beliefs and practices. An important question that rises at this point is “how can values be utilized in researching science teachers’ beliefs and practices?” Clare Graves (2005), a psychologist, who has developed an elaborate theory of value systems, seems to offer such framework. A brief description of Graves’s theory is in the following.

Graves (2005) developed his theory of value systems as a result of his nine-year-long study to describe the mature human being by investigating his own students’ perceptions about what characteristics a mature person should have. He discovered that there was not a single definition of maturity, but rather there were different definitions based on the value systems people hold. None of the definitions were more valid or better, but they were what the value systems necessitated. While trying to understand his data, Graves dealt with many different perceptions of life and related values and eventually he invented a theory of value systems, a result not intended initially. Graves continued his research by analyzing data and performing complementary studies for decades. He discovered that there are a few distinct value systems that can be described and these value systems form a developmental continuum. This continuum is hierarchical in that the complexity of the value systems change and more complex value systems encompass the less complex ones. Each value system at different levels of complexity can be described based on two things: “perceptions about life conditions” (beliefs about what the world is like) and “mind capacities” (the mindset required to deal with the world as it is perceived) (Graves, 2005; Cowan & Todorovic, 2000).

According to Graves’ theory (Graves, 2005), a person or a social group moves through the levels of value systems, as their environment and their mind capacities change. Factors such as

changes in life conditions, education, and maturation may influence the development through these levels. Usually, this movement is up the levels, however, when conditions necessitate, the movement could be down the levels. Graves emphasize that the levels of complexity in value systems do not relate to intelligence, which means a person can be very intelligent but have a relatively less complex value system. Graves also emphasize that, it is not possible to describe a person with only one level of value system, nor are there as many types of people as these levels. Rather, he talks about a typology of levels in which the values in one level dominate; however, values in other levels also exist at some intensity in an individuals mind at the same time. He argues that there are transitional stages between levels where individuals occupy when they face with value conflicts in their lives. Many people spend a long time and energy in transitional states, as they are challenged by changing life conditions and face new ways of thinking. Therefore as one level of thinking is left behind, new ways of thinking and related beliefs may be activated depending on how perception of life conditions change and the coping mechanisms these conditions necessitate. If there are no value conflicts, an individual may stay in one level for his/her entire life.

Graves and his students have so far identified eight levels of value systems, which are briefly described in Table 1 (Graves, 2005; Beck & Cowan, 1996). They emphasize that these levels do not describe the complete value systems structure of humans; however, they represent individuals' personal development throughout their lives as well as societies throughout history. Graves's (2005) theory suggests that people follow the sequence of development in Table 1 (from 1 to 8) as their values change over time. The theory also suggests that the focus in these value systems shifts between self and community. The "automatic, egocentric, rationalistic, and systemic" levels are self-oriented, while "animistic, authoritarian, pluralistic, and holistic" levels are community oriented. This theory provides a promising tool for describing value systems and explaining how people change their value systems. Using this model, the purpose of this study was to discover how the study of values may contribute to research on teacher beliefs and practices in science education. Specifically the following questions were explored:

1. How could science teachers' value systems be characterized based on Graves's theory?
2. How teachers' beliefs and practices relate to their value systems?

## 2. METHOD

This study was conducted in 2003 and 2004 in the South-Eastern USA. The research sites for this study were two middle and two high schools and the research participants were four science teachers of American origin (three females and one male) teaching in these schools. Their pseudonyms used in this research were Suzan, Sara, Aylin, and Brian. The participating teachers had varying degrees of teaching experience and different teaching styles, which increased the diversity of the data.

As values are not observable phenomena, qualitative-interpretive research methodology was used in this study. Specifically, a case was written for each teacher about their beliefs and practices based on interviews and classroom observations. The cases were discussed with the teachers through interviews, which allowed them to respond to interpretations and assertions about their beliefs and practices in a dialectical manner. Open-ended interviews, classroom observations, and a questionnaire called the "Values Test" were used as data sources for this study. The Values Test, developed by Beck and Cowan (2000), was used to determine the value systems that individuals prioritized. The Values Test was followed by interviews to discuss participants' responses and their reasoning for their choices. This procedure was repeated twice with an eight months interval to check for consistency of the results and to note changes, if any. The Values Test included 20 items and each item had seven choices representing each of the value systems of the developmental levels in Grave's model, except the "automatic" level (see Table 1). To check for reliability, 10 items were asked with a positive question root and the same 10 items were asked again with a negative question root (20 items in total). The participants were asked to distribute 15 points to the choices for each question. Scores given to the positive root items represented acceptance of values, while scores given to the negative root items represented rejection of the values. After participants responded to all of the items, the points were

summed up to see for which values they gave acceptance points and for which values they gave rejection points. The scores on the test do not represent a quantitative measurement; rather they are an ordinal measure of an individual's value system priorities.

Classroom observations were recorded in the form of written notes and expanded and typed later as field notes. Interviews were recorded and transcribed. The written data was then coded using category coding procedures suggested by Bogdan and Biklen (1998) and Miles and Huberman (1994).

**Table 1: Description of Value Systems According to Graves's Theory**

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1. **Automatic:** This is the simplest level, which is based on biological urges and drives. At this level physical senses dictate the state of being. This level is preverbal; the first level of consciousness and it is included in this list for the purpose completion of the levels. This level would be analogous to a new born baby, who would only react to stimuli. Because of this, it is not researched since normal people are beyond this level.

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  2. **Animistic:** In this level, the world is seen as a mystical and sometimes threatening place. People find safety within the communities they live in where people look out for each other. This system may be common among people who live in small towns, ethnic neighborhoods, or tribal communities. Marriage and family relations are very important in this level and people stay committed to home and extended family relations. Spiritual beliefs, rituals, and traditions are important in the animistic value system.

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  3. **Egocentric:** In this level, an egocentric value system is observed. The world is seen like a jungle where the strong dominate and the weak serve and therefore power is desired. Self-assertion for dominance is important in this level. The egocentric system is common in street culture, crime organizations, and populations of emerging nations with a large animistic subsystem. In this level there is a present time orientation, in other words what matters is now and future is not real.

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  4. **Authoritarian:** In this level, the world is perceived as an orderly place and that order has to be kept. Respect for authority, loyalty, patriotism, traditions, and rules are important. A life style based on "one true way" and "going by the book" in dealing with problems or issues in life is a characteristic of this level. Strict religious communities, highly structured societies, or highly bureaucratic organizations are places where this system is common. In this level there is a future time orientation, in other words, one need to sacrifice now to get rewards later. In this level, community needs are more important than individual needs.

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  5. **Rationalistic:** In this level, the world is seen as a place full of opportunities and resources. People who prioritize the rationalistic value system have an entrepreneur perspective in life. Capitalist values, technological advancement, economic power, and competition are valued within this system. In this level, maneuvering within the rules of an organization or a system to get ahead and testing available options in life to reach a goal are common attitudes. Business oriented communities, companies, and economically advanced or advancing nations would be places where this value system would be common. In this level the priority is given to self-advancement rather than the community. Bureaucracy and heavily structured systems are not valued in this level.

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  6. **Pluralistic:** In this level, concern for human feelings and needs is given priority. The world is seen as a habitat where peace and prosperity must be achieved and maintained. Relativism, post-modernism, multiculturalism, consensus building, and well being for all are respected ideas within this system. The roles of charity organizations or international organizations such as United Nations would be places where this system is common.

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  7. **Systemic:** In this level, people view the world as a complex system where change is the norm. World is seen as a place under the threat of humans' limited vision (such as fundamentalism, violence, terrorism, pollution, global warming, wars, etc.). People who value systemic thinking seek ways to fix the world's problems through knowledge, knowing that those problems also affect them. At this level people tend to have strong sense of independence, individual competence, and self-worth. They are not driven by fear, compulsiveness, or loss of status. They may express discomfort at over-simplified models and failure to recognize the true complexity of issues at hand. Systemic long-range thinking, questioning, and accepting differences are common attitudes in this system.

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  8. **Holistic:** In this level, the world is seen as a single living organism and life is valued as a whole. People at this level tend to be conceptual, they value learning through experience, searching for meaning and purpose in existence. This search for meaning goes beyond survival, obedience, competition, and peace and reaches spiritual levels. This level of thinking is globalist, extending across politics, religion, and vested interests.

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### 3. FINDINGS

Findings reported below in the form of cases for each participant. The results of the Values Test in Table 2 showed a general consistency in participants' responses both in terms of complimentary acceptance and rejection scores and also in terms of scores obtained with an eight months time interval. The first numbers are the results of the questionnaire when it was taken for the first time while the second numbers (separated by a dash) represent the results in the second round.

**Table 2: Values Test Results for Each Participant**

		Animistic	Egocentric	Authoritarian	Rationalistic	Pluralistic	Systemic	Holistic
Suzan	Acceptance	9-7	0-3	0-0	8-14	32-39	28-26	73-61
	Rejection	6-26	72-36	29-47	18-23	6-10	14-8	5-0
Sara	Acceptance	14-15	6-2	21-11	11-20	45-55	18-24	25-23
	Rejection	21-10	61-64	21-36	22-18	0-0	10-6	15-16
Aylin	Acceptance	0-3	3-7	0-0	4-7	36-23	69-58	38-52
	Rejection	42-35	30-34	45-34	27-24	0-13	4-6	2-4
Brian	Acceptance	9-0	7-2	56-54	21-28	33-37	15-14	9-15
	Rejection	48-62	50-34	0-0	0-7	0-0	7-5	45-42

#### 3.1. Suzan' Case

Suzan taught chemistry at a high school with a student population from the middle socioeconomic class. She had 18 years of experience when this study was conducted. She also held National Board of Professional Teaching Certification and had a doctoral degree in science education. Suzan was a very confident person as reflected in her values. She prioritized the holistic and pluralistic value systems in the Values Test (Table 2). Suzan saw herself as a learner and despite her advanced degree, awards, and experience; she never gave up trying to learn from others. She sought outside input and opinions about her teaching and methods she used. During her participation in this research, she was seeking criticism of her practice from the researcher. She always tried to understand how her students make sense of science and she explored different ways to help them learn. When asked what she enjoyed most in her teaching, she stated:

Playing with people's ways of making sense--when the students allow me to engage with their sense making--when they have developed the confidence to express themselves to the point that we can have an intellectual conversation, debate the way we view it and have a conversation about it; I like that because it gives me access to their way of thinking and I find that exciting. (Interview with Suzan, 5-6-2003)

Suzan's beliefs about the purpose of education and her practices associated with this belief seemed to conform to the high priority she gave to the holistic level in the sense that she was interested in the big picture. She believed that education was an opportunity for intellectual growth:

I think it would have been a more valuable experience if I realized that public education is an opportunity and we should be very grateful, thankful for that, that our culture is saying, 'here is an opportunity to learn and grow intellectually' and in this case socially. Instead, I saw it more as a task to be done and didn't engage as meaningful as I could. So my biggest challenge is to get [students] - even though this is about grades and they are going to put your GPA's up in ranking and all that - get them beyond it. (Interview with Suzan, 6-5-2003)

Suzan believed that for better learning, students needed to experience knowledge in different ways and they needed to be active and take responsibility in their learning. She emphasized the notions of "learning based on understanding" and "learning how to learn" more than the science content in her teaching. She rarely answered her students' questions directly and asked questions to stimulate their thinking. She stressed the process of reasoning rather than recall of facts. What Suzan expected from her students was to accept the challenge of learning and take action. She explained:

I believe that people - in order to learn something - need to experience it in multiple ways and they need to reinforce it and it has to be practical. So I design my classroom experiences where they are engaging, where it gets their attention, where it may generate an interest and then I give them enough of a hands-on, minds-on kind of experience that they can stay with you along the way and then they have to build a practice and check themselves. So we do a lot of practicing and checking after I have got them where they should be on their own. But the bottom line is, I see my job as plainly responsibility for the learning--helping them develop responsibility for learning. (Interview with Suzan, 2-20-2003)

Another reflection of Suzan's values was her contribution to the field of science education and the community of science teachers by participating in research projects that involved in-service training for science teachers. She tried to help science teachers grow intellectually, understand their powers, and be exposed to new ideas that may improve their teaching. This attitude of trying to improve the community that she was a part of was a characteristic of the holistic value system.

During our conversations and interviews, Suzan explained her rejection scores for the authoritarian value system. She expressed discomfort with ideas like "one true way". She said:

What I am trying to say is that the problem I had with closed minded people or people who believe they are righteous in what they do and they get strength from that, more power to them, but when they use that to put other people down - if you make your own religion, country, anything better by putting somebody down, I have a real problem with it. (Interview with Suzan, 11-16-2003)

Suzan's only complaint about her job was the bureaucracy in her school and frequent interruptions in her classes. This complaint also complemented her rejection scores for the authoritarian value system, common in organizations where there is too much bureaucracy.

### 3.2. Sara's Case

Sara was teaching science to sixth, seventh, and eighth grades with a student population from a lower and middle class socioeconomic status. After earning a Master's degree in science education, Sara started teaching in her school and she had three years of experience at the time of this study. Sara had the least amount of experience among the participating teachers and she did not have too much self-confidence in her job. Teaching was not exactly what she expected and she was not quite sure what caused the dissatisfaction in her job. She said several times during our interviews "something is missing" about her job. There seemed to be a mismatch between the ideal teaching context she dreamed of and the real context she encountered in school, which created conflicts for her. She said:

I wish I had been a teacher before I have started the Masters program. All the theory and philosophy, I would have taken it in differently. I remember in our classes when we got to write up our opinion on the web site and I was always saying "To those of you who are teachers, if you think I am so off base, tell me, let me know because I don't know. I don't know what it is like out there in the classroom" and nobody ever really said a lot about that to me, like "Be careful because you are dreaming really big". (Interview with Sara, 3-3-2003)

Despite the conflict she felt, Sara cared about her students many of whom have had negative experiences with schooling in the past and she saw her role as to provide a more caring and accepting environment for them. Regarding her students' failure in standardized tests, she asked many questions:

Are all these hands-on [activities] that we do in [my middle school] a waste of time? Should we care that these kids do not score as high as [Uptown Middle School (pseudonym)]? Does it have anything to do with hands-on versus bookwork? Is it just socioeconomics? (Interview with Sara, 12-16-2003)

Sara's feelings about her students were reflected in her values. She prioritized the pluralistic value system (Table 2) which conforms to her care for others and their needs.

Sara believed that the purpose of education was personal development of students by empowering them through learning new knowledge and new skills so that they can have more options in their lives. She saw teaching science as a canvas for achieving the broader purpose of education that she believed in. She valued learning based on understanding rather than memorizing. She thought that learning was the responsibility of students and she saw her role as to help students and to be a guide to them in their learning. She believed that students learn best when they are responsible for their learning and active, so she used hands-on activities often in her classes.

Sara respected other people's beliefs; however, she felt less comfortable dealing with people who try to force others to believe in a certain way or who offend others because of the beliefs they hold. This feeling was reflected in Sara's rejection scores for the authoritarian value system (Table 2). She talked about a recent experience that she had in her school:

One right way, all that stands out to me is my recent discussion with a colleague, this fundamentalist, who told me I was going to hell and so the [idea of] one right way automatically brings me to that discussion of her telling me that there is only one right religion and one right faith. I am having a very hard time with it. I wish we hadn't had the discussion, but I think it kind of affected my opinion about her as a person and I really kind of distanced myself from her for about two weeks and now I am getting over that but I think about it a lot, about that discussion. (Interview with Sara, 12-16-2003)

### 3.3. Aylin's Case

Aylin had nine years of teaching experience when this study was conducted. She was teaching science, math, and geography to sixth graders at a middle school. When she participated in this study, it was Aylin's first year of teaching science and she was teaching out of field. She held a Master's degree in social studies education and an Educational Specialist degree in Exceptional Education, but she did not have certification for science. By the time this study started, Aylin had applied for certification for teaching integrated curriculum that would allow her to be considered in field for teaching math, science, social studies, reading, and geography.

Aylin had high confidence in her teaching and this was reflected in her desire not to have interference from anyone in her teaching because she believed that she knew how to do her job very well. She wanted to have complete control in deciding what to teach or what to do in her classes, particularly when teaching social science. However, she was more open to suggestions or help from outside when teaching science due to her lower confidence in her content knowledge. She explained:

I had to get over some "Oh am I doing students a good service by teaching science? Will I be too much of a learner that I actually get in the way; that the students will not be further along than me"? You know, "Am I going to impede them in any way and their progress because I am not where they are"? Then I subordinate... (Interview with Aylin, 3-9-2003)

Despite her low level science content knowledge, Aylin had confidence in her teaching. Her self-confidence was reflected in her high scores for the systemic value system (Table 2). Another reflection of Aylin's acceptance of the systemic value system was her frustration with the education system she worked in. She thought that the policies of standardized testing and accountability made the education system inefficient. Even though she felt very frustrated with the school policies, she had a positive attitude towards the realities of the world around her. For example, in response to the question, "How do you deal with the challenges you face in your school?" she answered:

I laugh about them, but I don't know if that always works. I just see what I can learn from it. Because really, whenever you feel frustrated or upset, it is because you are desiring something that you are not getting and so if you can let go of that preconceived notion of what should be, you won't feel that way quite as much. (Interview with Aylin, 5-19-2003)

Aylin was willing to accept the outside world as it was, even if she felt uncomfortable with some aspects of it. This willingness to accept the world conforms to the systemic value system.

Aylin believed that the purpose of education was to provide the skills and knowledge that students needed to pursue their passions in life and she also believed that education was about personal development. She saw her role as to model learning for her students and she tried to teach them how to learn regardless of the subject. She was comfortable with assuming the role of a co-learner; however, she acknowledged that teachers needed to have a certain amount of content knowledge in order to guide their students well. Aylin also believed that ideally schools should provide a model for students for the real life that they will face after completing their formal education by giving them more responsibility for their learning and actions and allowing them to face the consequences of their actions. She realized that the intentions of schools were to protect students; however, she thought that the resulting control created false experiences. She remarked:

You know, ideally the classroom would be just like the real world. Because that is where they are going to be, and at schools it's like we alter the [reality]. It's like the Truman Show, we are altering the reality and then they graduate and we just toss them out there (Interview with Aylin, 5-19-2003)

Aylin's beliefs about the ideal role of schools in education indicated her long-range thinking about this issue, which is a characteristic of the systemic value system.

Aylin believed that part of her role as a teacher was to nurture her students. She tried to provide a safe environment for her students, where they could ask questions, make mistakes, and feel accepted. During class discussions, she created scenarios to which students had a chance to respond in various ways and she encouraged them to express their opinions freely. These attitudes were reflected in Aylin's acceptance toward the pluralistic value system.

#### 3.4. Brian's Case

Brian had taught all sciences to grades ranging from 9 to 12 and he had certification in all the areas he taught when he participated in this study. During this study he was teaching integrated science to ninth grades. He was an active member of the teachers union and served on many committees associated with science teaching such as the local science fair. He was also the chair of the science department in his high school. He had 26 years of teaching experience and had an Education Specialist degree in science education. He was the most experienced teacher among the participants.

Brian gave his highest acceptance scores to the authoritarian value system in the Values Test (Table 2). In this sense, his values and beliefs were different than the other three teachers. He described himself as a conservative and religious person. He explained:

A firm Christian believes, and [it is] a key part of my life, so any belief or value is going to be have to be centered on that. I don't think that we are necessarily ordained or destined to be a certain way ... There is a power within you to shape tomorrow even within the idea of a firm foundation, the Lord works within your life to do that. (Interview with Brian, 1-7-2004)

His values were reflected in his beliefs about the educational system he worked in. For example, he did not criticize the policies of standardized testing and teacher accountability. These policies imply an authoritarian attitude which was consistent with his dominantly authoritarian values.

Brian agreed that the purpose of education involved personal development of students; however, he also thought that it involved preparing the future citizens for the job force that the society needed. This was a belief that was not expressed by the other three teachers, and it was consistent with Brian's community centered, authoritarian values. He believed that education starts as the responsibility of the state and at a certain stage it becomes the responsibility of students. He argued that many students did not realize this responsibility and expected continuous adult supervision He expected students to share the responsibility of learning with the teacher. He said:

I want you to be aware of the fact that I am not negating my responsibility, [when I say students need to be more responsible in the teaching and learning process]. I am saying meet me somewhere along the way, whether it is a third of the road, or half of the road would be more ideal, but meet me somewhere where I can see where you are in terms of this process. When a student sits back, I guess my biggest example of this would be when they say, "I don't understand anything". How can you not understand anything and be in a classroom? You have to understand something. So where can I begin this construction of knowledge with you if you are going to say I don't understand anything? And so to me that is irresponsible. (Interview with Brian, 1-7-2004)

Brian split the responsibility of learning more equally between teachers and students. Suzan also believed that students should be responsible for their learning and she used methods to help her students to understand their responsibility whereas Brian simply expected it.

In his practice Brian mainly used lecturing and very few hands-on activities. He cited the unavailable resources and safety concerns as the reasons for not being able to do hands-on activities often. He criticized teachers who did hands-on activities and experiments in school facilities that had incomplete safety equipment. This shows that Brian valued the notion of going by the book in his practices, another attitude consistent with his dominantly authoritarian value system.

When it came to the purpose of teaching and leaning science, Brian emphasized content unlike other three teachers. According to Brian, the purpose of teaching and learning science was to achieve scientific literacy in science and content was an important part of the scientific literacy. Brian wanted his students to understand science content so that they could make informed decisions about science related issues that affected them or their society. He wanted his students to have opinions about environmental and other popular science related issues.

Brian also gave acceptance scores to the pluralistic value system in the Values Test (Table 2). This was reflected in the responsibilities he took within his community. For example, he took charge in the administration of a teacher union organization and also local science fair events. During one of our interviews, Brian explained that he did not agree with all aspects of the teacher union organization that he worked for; however, he valued the idea that everyone should have a chance to express their opinions and be heard. He explained that unions were associated with liberal thinking, but he saw himself more of a conservative person. He was also the only teacher who had higher acceptance scores than rejection for the rationalistic value system.

#### **4. DISCUSSION AND CONCLUSION**

Exploring the participating teachers' beliefs and practices through the framework of values delivered a depth of understanding that was otherwise unavailable. Many of the teachers' beliefs and practices seemed to conform quite well to their values. Especially when, Suzan's and Brian's cases, the two most contrasting teachers, were compared, this conformity could be observed better. When one looks at the cases of each of the participating teachers, it is possible to see that teachers who had similar values also had similarities in their beliefs and practices. Although other factors such as experience, content knowledge, and context influence teachers' beliefs and practices, values do seem to have an influence as well. For example, Suzan, Sara and Aylin had highest acceptance scores for the holistic, pluralistic and systemic value systems respectively and they all were frustrated with the education system that emphasized accountability and standardized testing. Brian on the other hand, having a dominantly authoritarian value system, valued and accepted these policies.

Every reform effort of change in education represents introduction of different or new values. When values conflict and not enough support is provided to teachers to cope with these conflicts, change is not likely to happen. A nice example of this is shown by Davis & Blanchard (2004) where they show that a university professor's efforts to introduce new ways of teaching (collaborative team work in this case) in a statistics course did not yield desired results. Because the values of the

institution and the assessment policies these values dictated, the values of the students who took the course, and the values that informed the new ways of teaching conflicted.

From the findings above, it can be argued that the two research questions mentioned above can be answered favorably towards the use of Graves's value systems theory in studies concerning teacher beliefs and practices. Graves's theory seems to have characterizes teachers' value systems and their relation to teachers' beliefs and practices fairly successfully. I suggest further studies of teachers' beliefs and practices using value systems as a reference which may lead to design of pre-service and in-service teacher education programs that are informed by the value systems perspective.

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## Geniş Özet

Fen öğretmenleri, fen eğitiminde yapılan tüm reform çalışmalarının uygulayıcıları olduklarından bu reform çalışmalarının başarısında en önemli faktördürler. Fen öğretmenlerinin eğitim ve öğretim hakkındaki inançları ve bu inançların onların öğretimi nasıl etkilediğini anlamak öğretmen eğitiminde önemli bir konudur. Nitekim bu anlayış fen öğretmenlerinin gerek hizmet öncesi, gerekse hizmet içi eğitiminde, eğitimsel reform çabaları çerçevesinde düzenlemeler yapabilmek için gereklidir. Bu nedenle, fen eğitimi literatüründe fen öğretmenlerinin inanç ve mesleki uygulamaları ile ilgili birçok çalışma vardır. Fakat bu çalışmalar genelde fen öğretmenlerinin eğitim ile ilgili belli konulardaki inançlarını incelemektedir. Bu çalışmada inanç olgusuna daha geniş bir perspektiften bakmanın daha faydalı olabileceği önerilmiştir. “Değerler” ve “değer sistemi” kavramlarının, öğretmenlerin eğitim-öğretim ile ilgili inançları ve bu inançların pratiğe yansımaları konusundaki araştırmalara daha geniş bir perspektif sağlayabileceği öne sürülmüştür.

Bu çalışmada bir psikolog olan Graves (2005) ve öğrencilerinin geliştirdiği ve değer sistemlerini tanımlayan ve değişimlerini açıklayan bir model kullanılmıştır. Bu modelin seçilmesinin sebebi kişilerin değer sistemleri ile inanç ve davranışları arasındaki ilişkiyi açıklamada başarılı bir model olmasıdır. Graves ve öğrencileri, geliştirdikleri modele göre sekiz değer sistemi belirlemişlerdir ve bu değer sistemlerinin karmaşıklık açısından hiyerarşik bir desen ortaya koyduğunu önermişlerdir. Bu desene göre değer sistemleri karmaşıklıkları bakımından şu şekilde sıralanabilir:

1. Otomatik: Biyolojik dürtü ve güdülerin egemen olduğu, yeni doğanlara özgü bir sistemdir. Basitliği nedeniyle araştırma konusu olmaz.
2. Animistik: Dünyayı mistik ve bazen tehlikeli bir yer olarak gören bir değer sistemidir. Toplum odaklıdır, küçük toplumlarda ve kabile yaşantısında görülebilir.
3. Egosentrik: Dünyayı güçlülerin hakim olduğu, zayıfların ise hizmet ettiği bir ortam gibi gören bir değer sistemidir. Ben odaklıdır, suç organizasyonlarında, çetelerde, bazı aşiretlerde görülebilir.
4. Otoriter: Dünyanın bir otoritenin kontrolü altında düzenli bir yer olarak görüldüğü ve hayatın bir anlamının ve amacının olduğu bir değer sistemidir. Toplum odaklıdır, dini kurumlarda, katı toplumlarda ve aşırı bürokratik organizasyonlarda görülebilir.
5. Rasyonalist: Dünyayı fırsatlarla ve kaynaklarla dolu gören, katı kuralların ve bürokrasinin önemini yitirdiği, fırsatçılığın, rekabetin, gelişimin, bilim ve teknolojinin önemsendiği bir değer sistemidir. Ben odaklıdır, kapitalist toplumlarda, büyük şirketlerde ve sanayileşmiş ülkelerde görülebilir.
6. Çoğulculuk: Dünyanın barışın ve refahın sağlanması ve korunması gereken bir yer olarak görüldüğü değer sistemidir. Toplum odaklıdır, çevre koruma ve insani yardım ile ilgili uluslararası organizasyonlarında görülebilir.
7. Sistemik: Dünyanın karmaşık ve hayranlık uyandıran bir sistem olarak görüldüğü bir değer sistemidir. Ben odaklıdır.
8. Holistik: Dünyanın tek bir yaşayan organizma gibi görüldüğü ve tüm hayatın (sadece insanlarınki değil) önemsendiği bir değer sistemidir. Toplum odaklıdır.

Graves'in teorisine göre bu değer sistemleri 1'den 8'e doğru gidildikçe daha karmaşık bir yapı alırlar ve toplum odaklı ve ben odaklı olmak üzere iki tür özelliği dönüşümlü olarak gösterirler. Fakat bu hiyerarşik sıralama insanların zekâları ile ilişkili değildir. Değer sistemleri sadece kişilere değil, kurumlara ve organizasyonlara özgü de olabilirler. İnsanlar bu değer sistemlerinden sadece biri ile tanımlanamazlar fakat bunlardan birkaçı ile uyum gösterebilirler ve genelde bunlardan biri diğerlerine göre baskındır. İnsanlar bu değer sistemlerinden biri içerisinde gelişebilirler veya çevresel şartlara göre farklı bir değer sistemini benimseyebilirler. Bu benimseme şartlara göre daha karmaşık veya daha az karmaşık bir sistem için olabilir. Bazı insanlar değişime açıkken bazıları belli bir değer sisteminde radikalleşebilirler. Değer sistemlerinde değişim genelde inanç ve değerler ile yaşanan tecrübe veya beklentiler arasındaki tutarsızlık sonucu tetiklenebilir. Bir insan daha karmaşık olan bir değer sistemini benimsese bile, önceki değer sistemleri kaybolmaz ve şartlar değiştiğinde bunlar yine baskın hale gelebilirler.

Bu model yardımıyla Amerika Birleşik Devletlerinin güney doğusundaki bir eyaletinde çalışmakta olan ve takma isimleri Suzan, Sara, Aylin ve Brian olarak belirlenen dört öğretmenin değer sistemleri, eğitim ve öğretim hakkındaki inançları ve mesleklerini pratikte nasıl uyguladıkları arasındaki ilişkiler incelenmiştir. Bu çalışmaya katılan öğretmenlerden üçü bayan, diğeri erkektir ve hepsinin çeşitli düzeylerde öğretmenlik tecrübeleri vardır. Bunlardan ikisi lise düzeyinde (Suzan ve Brian) diğeri ikisi de ortaokul düzeyinde eğitim vermektedir. Bu çalışmada yorumlayıcı-nitel metotlar kullanılmış olup veri toplama araçları olarak mülakatlar, sınıflarda yapılan ve kayda geçirilen gözlemler ve Beck ve Cowan'ın (2000) geliştirdiği kişilerin değer sistemleri ve öncelikleri hakkında bilgiler veren bir test kullanılmıştır.

Verilerin analizi sonunda şu sonuçlara ulaşılmıştır: Suzan holistik değer sistemini kendine en yakın görmüştür. Değer sisteminin bir yansıması olarak Suzan yeniliklere açık, eğitime daha geniş bir perspektiften bakan, karşılaştığı sorunlar karşısında yapıcı bir tavır takınan, kendine güvenen, tecrübelerini paylaşmayı seven ve güçlü bir sorumluluk bilincine sahip bir öğretmen görüntüsü çizmektedir ve eğitimi kişisel gelişim için bir fırsat olarak görmektedir. Suzan, hayatta tek bir doğru yol olduğuna inanmayan ve dini inançlara saygı duymakla beraber onları sorgulayan bir yapıya sahiptir.

Sara, çoğulculuk değer sistemine öncelik vermiştir. Buna uygun olarak öğrencilerinin ihtiyaçlarına ve gelişimlerine büyük önem veren, onların başarısızlığı durumunda kendini suçlayan, okulda üzerine yüklenen sorumluluğun ve karşılaştığı sorunların ağırlığı altında stres duyan, fen alan bilgisi açısından kendini yetersiz bulan ve bu nedenle kendine güveni az bir görünüm çizmektedir. Eğitimi öğrencilere güç veren ve gelecekte daha fazla seçenekleri olmasını sağlayan bir fırsat olarak görmektedir. Hayatta tek bir doğru yol olduğuna inanmayan bir kişiliğe sahiptir.

Aylin, sistemik değer sistemini kendine en yakın görmüştür. Buna uygun olarak kendi fen alan bilgisini yetersiz bulduğu halde öğretiminde kendine güvenen, okulda karşılaştığı sorunların eğitim sisteminden kaynaklandığını düşünen, çalışma ortamında kendisine yüklenen sorumluluklardan dolayı stres yaşayan fakat bu stresin üstesinden gelebilen bir öğretmen görüntüsü çizmektedir. Aylin, kafasındaki ideal dünyanın her zaman kendi istediği gibi olamayacağını düşünen ve bu sayede karşılaştığı sorunlara daha yapıcı bakabilen bir kişiliğe sahiptir. Suzan ve Sera gibi eğitimi kişisel gelişim için bir fırsat olarak görmektedir.

Brian ise diğeri öğretmenlerden farklı olarak otoriter değer sistemini kendine en yakın görmüştür. Brian dini inançlarına bağlılığını ön plana koyan, mesleğinde karşılaştığı sorunların kaynağını kendi dışında gören bir yapıya sahiptir. Eğitimin amacını toplumun gelecekteki ihtiyaçlarını karşılamak olarak görmektedir. Tecrübesine dayanarak kendine güvenen bir öğretmen olmasına rağmen, öğrencilerin başarısızlığı durumunda kendisini sorumlu görmeyen bir yapısı vardır.

Bu sonuçlar göstermiştir ki öğretmenlerin farklı tecrübe ve değer sistemleri onların inançlarını ve eğitime yaklaşımlarını etkilemektedir. Buna dayanarak öğretmenlerin eğitime yönelik inanç ve sınıf ve okul içi uygulamalarının, değer sistemi perspektifi ile incelenmesinin daha yararlı bir yol olduğu görüşü ortaya atılmıştır. Öğretmen eğitimi ile ilgili araştırma yapan eğitimcilerin bu perspektiften yararlanarak daha bilinçli hazırlanmış öğretmen eğitimi programları geliştirebilecekleri önerilmiştir. Fen öğretmenlerinin değer önceliklerinin belirlenmesinin onların eğitim ile ilgili inançlarının ve eğitim-öğretim sürecindeki tercihlerinin daha iyi anlaşılmasını sağlayacağı ve onların gelişimine bu sayede yardımcı olacağı düşünülmektedir.