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Fostering Resilience: A Necessary Skill for Teacher Retention

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Abstract The goal of this qualitative 2-year study was to examine the resilience building process in four novice secondary science teachers and its link to teacher retention. To achieve the research goal, a resilience framework was established. Three factors were instrumental in creating the framework. The first focused on stressors and protective factors in the lives of novice secondary science teachers and provided direction and goals for the research. Second, a case study was developed for each of the four teachers participating in the research in order to emphasize the detailed analysis of factors linked to resilience. Finally, cross-case analysis was employed to identify similarities and differences and provide insight into issues concerning the resilience process. Results of this study suggest that the interaction between stressors and protective factors acts as a primary force in the resilience process and stimulate responses to help counteract negative effects of resulting stress. Therefore, it can be reasoned that resilience can be fostered in novice teachers as a means to encourage teacher retention.

Keywords Resilience · Resilience process · Resilience framework · Stressors · Stress · Protective factors · Novice science teachers · Support systems · Mentors

The manuscript is based on data also used in a longitudinal study for a doctoral dissertation entitled, "The Resilience Process in Novice Secondary Science Teachers" by Patricia A. Doney, 2010.

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Introduction

The initial years in any occupation often lay the foundation for succeeding years. To be successful, individuals in new job situations adopt protective safeguards that allow them to exist and often thrive as they adjust to their new environment. Given these assumptions, studying teachers who have adapted and been successful in their initial years of teaching provides a means to uncover factors that contribute to teacher retention.

Concern with teacher retention has prompted a wide array of research including those that support induction and mentoring for new teachers (Koballa and Bradbury 2009; Wong 2004), professional development (Guskey 2003; Kahle 1999; Loucks-Horsley et al. 2003) and teacher learning investigations (Loughran 2007; Wallace 2003) as a means to teacher sustainability. Yet, the notion of building resilience through overcoming adversities experienced by novice teachers has only recently received attention (Gu and Day 2007). There is clearly a need to better understand how the resilience process takes place within individual teachers and the role that stressors and protective factors play.

The purpose of this research was to examine the resilience building process in four novice secondary science teachers in order to understand how and why some novice science teachers remain in the profession while others choose to leave. This research study focused on two primary questions: How is resilience developed in novice secondary science teachers and how does resilience affect novice teacher retention? Although much research has focused on resilience in environmental (Holling 1973) and psychological (Jean Baker Miller 1986) professions, little research has focused on factors that develop resilience in novice secondary science teachers and even less on how protective factors and stressors interact to overcome the resulting stress. This study endeavors to address the gap in written research centered on resilience building as a means of teacher retention by providing research in support of the notion that resilience can better prepare teachers to adjust to changing conditions of education (Bobek 2002; Gu and Day 2007; Howard and Johnson 2004).

Theoretical Framework

Resilience as a framework is consistent with the perspective that the study of developmental processes under extraordinary conditions can inform our understanding of both typical and atypical developments (Linley and Joseph 2004). "Prevention scientists and advocates of a positive approach to psychology have touted the resilience framework for its potential to inform efforts to foster positive developmental outcomes among disadvantaged children, families, and communities" (Linley and Joseph 2004, p. 521). In this study, the framework is based on resilience theory and its close link, relational culture theory.

Resilience Theory

"Resilience theory speaks to the strengths that people and systems demonstrate that enable them to rise above adversity" (VanBreda 2001, p. 1). Resilience theory

addresses individuals, families, communities, workplaces, and policies. This theory signaled the reduction in emphasis on pathology and an increase in emphasis on strengths (Rak and Patterson 1996). The change in focus corresponds to that of other research in child development and education (O'Leary 1998), in which evolving data led researchers away from the notion that resilience was an internal phenomenon, into studying the external factors implicated in the development of resilience (Masten et al. 1990). VanBreda (2001) noted that resilience theory had its roots in the study of children who proved resilient despite adverse childhood environments. McCubbin and McCubbin (1992) likewise noted that both theory and research have advanced in directions of strengths and capabilities, thus enhancing the capability for intervention. Resilience is something that promotes compassion, flexibility, and ability to bounce back after an encounter with adversity (Schwartz 1997).

An important component of resilience is the "presence of protective factors (personal, social, familial, and institutional safety nets) that enables individuals to resist life stress" (Kaplan et al. 1996, p. 158). The most well-known study on the concept of protective factors is the study conducted by Werner and Smith (1982, 1992) on children from Kauai, Hawaii. "The protective effect of personal and social resources at various ages were examined by comparing these resilient individuals with those exposed to similar risk, who had developed behavioral problems" (Losel and Bender 2003, p. 136). Those children labeled as resilient exhibited the following protective factors: active, sociable, easy tempered, independent, and self-confident. They also developed reliable bonds to persons inside and outside the family, received social support from adults and other caring individuals, had high self-esteem and an internal locus of control.

Research does suggest that coping strategies are protective in that they enable an individual to cope with the stressful situation successfully and recover (Steinhardt and Dolbier 2008). Coping strategies are a piece of protective factors and as such encompass strategies that are task-oriented, emotional-oriented, and avoidance-oriented (Mundia 2010). Pearlin and Schooler (1982) in their research on structuring coping mechanisms described the first as responses that change the situation out of which stress arises. The authors suggested that this type is not often used, as people do not always recognize the situation, which is causing the stress. The second, responses that control the meaning of the stress, is the most common type. This mechanism can entail making positive comparisons to reduce the severity of the stressful situation, ignore parts of the situation and concentrate on less stressful aspects of the situation and reduce the relative importance of the risk factors in relation to one's overall life situation. The third, responses that function more for the control of the stress after it has emerged, does not attack the situation itself. The focus involves basic stress management responses such as exercise or involvement in hobbies. A group intervention based on Pearlin and Schooler's (1982) "model of coping and adaptive behavior: attacking the problem, rethinking the problem, and managing the stress" (p. 105) created the links between theory, practice, and research on resilience, thereby increasing support from work sources promoting positive constructive coping skills. In so doing, this further supported the move toward focusing on one's strengths rather than deficits.

Focusing on strengths became the central premise for those researchers linking the resilience theory to resilience in teachers. Bobek (2002), similar to resilience research conducted by VanBreda (2001) and Masten et al. (1990), defined teacher resilience as the ability to adjust to a variety of situations and to increase one's competence in the face of adversity. Bobek further asserted that studies of resilience in children, families, and other occupations are applicable to resilience found in novice teachers. In conjunction with Pearlin and Schooler's (1982) studies, Tait argued that self-efficacy is a characteristic of a resilient teacher in that efficacious teachers see stressors as challenges rather than threats. Howard and Johnson (2004) noted in their studies that resilient teachers are those that can resist stress through the use of protective factors and learned strategies. LeCornu (2009) concluded that developing resilience in novice teachers is reliant on the formation of growth-fostering reciprocal relationships.

Relational Culture Theory

Nested within the notion of resilience theory is relational culture theory (RCT). Where resilience theory speaks to the strengths of individuals in overcoming adversity, RCT depicts those strengths as the result of human connections. In conjunction with a large body of research that supports the importance of factors within the individual such as temperament, hardiness, and intelligence, there is also research supporting the importance of relationships in the development of psychological resilience (Jordan 2006a, b). Rooted in the works of Jean Baker Miller, RCT posits that individuals grow through and toward human connections that foster mutual support. Growth-fostering relationships generate a "sense of zest increasing clarity, productivity/creativity, a sense of worth and desire for more connection" (Jordan 2006a, b, p. 4). Like resilience theory, RCT focuses on overcoming adversity, but emphasizes that it is accomplished through the promotion of mutually empowering, growth-fostering connections in the face of adversity (Jordan 2006a, b). Jordan emphasizes that promoting relational development helps individuals grow through and beyond experiences of hardship and adversity.

Methods

This research is based on an interpretative case study approach (Merriam 1991) to investigate how four selected high school science teachers reacted to stressors during their initial years of teaching. Consistent with interpretive case study, an in-depth 2-year investigation took place in the real-life context of four teachers (Yin 1994) with a focus on human interpretations and meaning. As such, this approach was used to guide interview questions and to use those interviews as the main source of data and reflection. Data collected during the first 2 years of teaching consisted of (a) six interviews conducted after school to gain an understanding of the individuals and their experiences (Seidman 2006). Interpretation relied on data reduction, data display and verification; (b) a response to a written prompt on a resilience in nature (noted as an integral part

in developing the resilience theory and theoretical framework in this study) later used in succeeding interviews for extension and clarification of participants' definition of resilience; (c) classroom observations conducted each semester to gain a better understanding of the participants within their contextual lives; (d) relational maps developed by each participant for each year of the research to better understand changing stressors and protective factors; and (e) work shadowing for one full day for each participant to provide realistic job information. In accordance with the interpretive approach, data was then compiled into four case studies (Chin 1989; Merriam 1998). Cross-case analysis followed to identify similarities and differences and to provide rich insight into issues concerning resilience in novice secondary science teachers.

Participants

Participants in this study included four females. Each had recently completed a secondary science teacher education program at a large state university in the southeastern United States. Recruitment of these teachers was based on the following: (a) certified as a secondary science teacher by the state education agency; (b) employed full-time at a public high school; (c) completed science-specific teacher preparation program; and (d) were observed during their student teaching by their university supervisor to have exhibited some coping mechanisms.

The participants come from various backgrounds and experiences. Participant one, Sara, is a single 24-year-old Caucasian female with a B.S. degree in science (Biology) and M.Ed. in Science Education. She is certified to teach 6–12 Science (Biology) and 6–12 Earth and Space Science. She completed her student teaching at a rural high school teaching classes in ninth grade Biology and 10th grade Physical Science before accepting the job as a biology teacher.

Participant two, Barbara, is a single 29-year-old Caucasian female. She has a B.A. in Biology and M.S. in Marine Science. She has a T-5 certification in Science (6–12) and Biology (6–12). T-5 indicates teacher certification at the master degree level. She worked as a research assistant and laboratory assistant at a southeastern university and learned research techniques and field experience. Her student teaching experience included 10th grade Advanced Biology and 12th grade Environmental Science before accepting a job in a rural high school.

Participant three, Linda, is a married Caucasian female and has a 2-year-old daughter. She attended a pre-med program before becoming certified in both Biology and Physics and completing her master degree. She was hired by the suburban high school in which her student teaching was conducted.

Participant four, Jennifer, is a single 29-year-old Caucasian female with a B.S. degree in Science Education. She is certified to teach Biology, Broad Field Science, AP Environment, and English to Speakers of Other Languages (ESOL). She completed her student teaching at a rural high school, teaching classes in Biology and Environmental Science before accepting the job as an ESOL Biology teacher at a suburban high school.

Procedures

Data were collected to answer the primary questions: (a) How resilience is developed in novice secondary science teachers and (b) does resilience affect novice teacher retention. Data were used to formulate the resilience framework, and in turn, the framework was used to help interpret the data. As noted in Fig. 1, resilience is based on the interaction of stressors and protective factors. This framework is congruent with the resilience process identified by larger-scale studies noted in the theoretical framework.

The primary source of data collection was interviews. Over a 2-year period, six interviews were conducted and each interview was audio recorded and transcribed. Each interview had a specific focus. Table 1 indicates the focus and summary of the core questions for each interview.

A contextual profile was established for the schools in which the participants were teaching. Table 2 indicates the type of school, the total student population, and

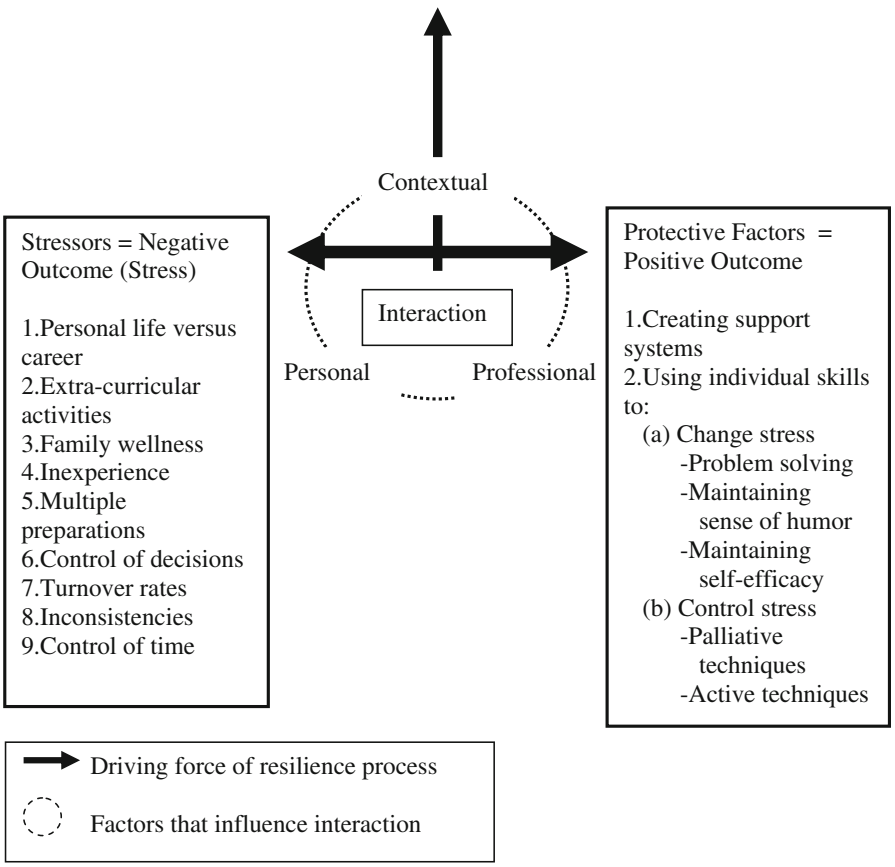

Fig. 1 Process framework

Table 1 Core interview questions

Interview	Focus	Protocol
1	Providing background information	1. Describe your teacher preparation background
		2. Tell me about the individual you would characterize as your mentor and how you interact with that person
		3. Describe your teaching assignment and schedule
		4. Tell me about your school
2	Discussing extra-curricular activities that may act as stressors and establishing a relational map of support systems	1. Describe the type of extra-curricular activities you are involved outside of the classroom
		2. Create a relational map by placing your name in the center of the paper and the names of all the people you feel support you in your school efforts and how they support you. Include family and friends if they apply
3	Job shadowing to better understand participant's contextual life and completing written prompt for personal definition and examples of resilience	1. The written prompt described an animal that was resilient to many adverse conditions in nature. What relationship do you see between your resilience and your staying in the science teaching profession and remaining at your current school of employment for a second year?
		2. What factors have facilitated your resilience as a first year teacher?
4	Establishing name and function of significant support person	The individual deemed to be the most significant support person in the participant's academic career was interviewed
		1. Tell me about your relationship with the research participant
		2. How were you assigned to mentor this person?
		3. Explain the types of help or assistance or guidance that you give
		4. Does your work as a mentor fit into a larger beginning teacher induction offered in the school?
5	Recording personal definition of resilience. Discussing stress and protective factors most often used by participants. Creating second relational map to use as comparison	1. What is your definition of resilience?
		2. Describe how you would recognize a resilient teacher
		3. How effective do you feel you were in your first year of teaching? Give examples. What would you change?
		4. What do you consider stressors that would make it difficult for you to carry on teaching? Tell me about the resulting stress
		5. What are some things you do to combat the stress you feel?
		6. Create a relational map that exemplifies your support system during your second year of teaching. Include ways in which each individual offers support
6	Elaborating on previous information and discussing why participant chose to remain in the profession	Protocol for each participant in the final interview was modified to elaborate on areas in need of additional data
		1. Why did you decide to remain in the profession for a third year?
		2. Do you see this as a long-term career path? Explain

economic data. Note that Sara and Jennifer were teaching at the same school for the duration of this research. School profiles provided significant information that aided in building cases by providing insight into the contextual lives of the participants.

Table 2 Type of school, student population, and economic data

Participant	Type of school	Enrollment	Student population	Free & reduced lunch eligibility (%)	Median household income by zip code	Total pupil expense
Sara	Suburban	2,522	80 % White 8 % Hispanic 6 % Asian 3 % Black 3 % Native American	8	$72,331	$11,777
Barbara	Rural	2,116	74 % Black 19 % White 5 % Hispanic 2 % Asian and Native American	76	$37,044	$11,757
Linda	Suburban	1,470	70 % White 17 % Black 7 % Asian 5 % Hispanic 1 % Native American	37	$42,140	$8,575
Jennifer	Suburban	2,522	80 % White 8 % Hispanic 6 % Asian 3 % Black 3 % Native American			

Each participant created two relational maps. The relational maps are visual displays of all the connections in the participants' support networks, including family, friends, co-workers, and mentors. Use of the relational map stems from the relational culture theory that is an integral piece of the foundation used as the framework for this research. The purpose was to visually understand the connection between the relationships developed and the stressors encountered. A description of the type of support received is provided with each link. The relational maps provided a key to understanding why each teacher chose their particular support system and how each support was used. The maps also provided a means by which to compare changes in stressors and protective factors between years one and two.

Table 3 is the rubric used for classroom observations and work shadowing to focus on situations that seemed to elicit stress responses. Responses were identified based on facial expressions, voice, and body movements (Mortillaro et al. 2012). Follow-up discussions with participants aided in elaboration of type of response elicited during observations and whether that response constituted a negative

Table 3 Situations that elicit stress responses

Participant Date	Personal	Professional	Contextual
Stressors	Caused by	Caused by	Caused by
	1. Personality characteristics	1. Students	1. School culture
	2. Family/friends	2. Adults	2. School administration
	3. School	3. Teaching schedule/ content	3. School personnel
Stress	1. Physical	1. Physical	1. Physical
	2. Emotional	2. Emotional	2. Emotional
Protective Factor Invoked	1. Internal/external	1. Internal/external	1. Internal/external
	2. Direct/palliative action taken	2. Direct/palliative action taken	2. Direct/palliative action taken

outcome. Clarification as to whether resulting stress manifested itself as physical or emotional was also noted. Additional information was gathered on whether the action taken to counteract the stress was direct or palliative or a combination as indicated in Table 3. Threads common to all four teachers were identified and noted, as were differences. Responses were then categorized as personal, professional, or contextual, consistent with findings from research (Kaplan et al. 1996; Gu and Day 2007; Smith-Osborne 2007). Data were analyzed, and a case study was formulated for each of the four participants. Individual cases were then analyzed and emergent themes noted during cross-case analysis.

Findings

In conjunction with historical research in both the Resilience and the Relational Culture Theory, the major finding of this investigation includes the notion that resilience is not an innate personality trait, but rather a process that is both internal and external resulting from positive adaption to adversity (Gu and Day 2007; Luthar et al. 2000). In addition, this research posits that interaction between adversities and protective factors occurs within the participants' personal, professional, and contextual lives and comprises the driving force behind the resilience building process as shown in the Fig. 1. These findings are similar to those in studies conducted by Henderson and Milstein (2003), which suggested that a person's resilience in different negative circumstances, whether connected to personal or professional factors, can be enhanced or inhibited by the nature of the settings in which that person works, the people he or she works with and the strength of beliefs or aspirations.

Also noted in Fig. 1, the findings that two categories define protective factors: (a) the use of individual skills (LeCornu 2009; McCubbin and McCubbin 1992;

Schwartz 1997; VanBreda 2001) and (b) and creating support systems (Jordan 1992; Miller 1986).

Use of Individual Skills by Participants

Individual skills include problem solving, maintaining a sense of purpose, having a sense of humor, and maintaining self-efficacy to counteract stress. Each of the participants used their individual skills to elicit positive outcomes.

Sara

Sara is a self-admitted type "A" personality driven by the need for perfection and respect. Scott (2007) depicts the type "A" person as achievement oriented and impatient with delays. These persons are often competitive and work obsessed. Sara's personality prompted stress when she took on several extra-curricular activities. At the same time, her personality acted as a protective factor by rationalizing that taking on extra work and being highly organized was helping her to achieve her goal to be an excellent teacher. With the rise of each situation that Sara identified as stressful, she was able to recognize the source of the problem and then mobilize action toward modifying it. When commuting to and from school through heavy traffic became too stressful in her first year of teaching, Sara moved to an apartment closer to the school during her second year of teaching. When student behavior was difficult and challenging, she used classroom humor and teaching strategies that included a course plan to give students practice that would make it possible for them to achieve the course goals. When she was overwhelmed by administrative demands, she used her organizational skills to effectively plan her time and stay current on mandatory weekly and monthly reports due to administrators. Sara's most prominent factor in negotiating stressors was her ability to make connections and build extensive support systems characterized by personal, professional, and contextual connections that targeted internal and external risk factors during her initial years of teaching as a novice secondary science teacher.

Barbara

Barbara's case centered on risk factors associated with her school culture. Stress resulted from Barbara's inexperience with low performing students in a school whose ethnic majority was different from her own. In addition, Barbara also encountered stress due to the high turnover rates in administration and school faculty that was a part of the school's history as well as limited programs available for novice teachers to ease the transition from university to classroom. Despite these challenges, Barbara worked aggressively toward understanding her students' diverse needs. She used problem-solving strategies to find ways to bridge the gap between her cultural mindset of teaching and creating an environment that was conducive to learning for her students. Working with students in after school programs and getting to know students on an individual basis contributed to her sense of self-

efficacy. In addition, Barbara met with administrators, faculty, and parents to build a more stable environment for her students.

Linda

Linda's first room assignment was in a non-science classroom in a wing of the building some distance from other science classrooms and science teachers. During the second semester of her first year of teaching, Linda spent time rotating through classrooms, creating stress associated with continually moving materials into different rooms. To counteract the stress resulting from changing classrooms, Linda employed direct action (Pearlin and Schooler 1982). Linda was very adept at identifying the problem and finding ways to change the situation from which the problem arose. By directly addressing the classroom problem with her administrator, Linda was given her own classroom during her second year of teaching. When money was needed for supplies for the microbiology classes, she worked with another faculty member to write a grant. When she was uncertain about discipline issues, she contacted administrators or faculty personnel that helped her to understand what procedures to follow.

Jennifer

Shortly after accepting her new teaching position, Jennifer was contacted by the head of the English to Speakers of Other Languages (ESOL) department to see whether she was interested in teaching ESOL biology classes. The stress of beginning a new career and taking on ESOL learners prompted Jennifer to take direct action. Jennifer accepted the position and enrolled in the Sheltered Instruction Observation Protocol (SIOP) training and ESOL conferences to better prepare to teach biology to ESOL students. Like Linda, Jennifer also worked in a non-science classroom and had to adjust her lessons to fit her environment. Jennifer also helped Sara with coaching the cheerleading team as a means to get to know students and parents during her first year of teaching.

Teachers who were flexible in handling new demands, used problem solving to alleviate stress, and maintained a sense of humor were better able to remain positive and overcome adversities. These outcomes correspond with research conducted by Losel and Bender (2003) in which children labeled as resilient exhibited similar characteristics. In addition to individual skills, all four participants in this research also used palliative techniques to counteract the stress incurred during their initial teaching years. Sara joined a softball team, which enabled her to release stress through physical activity. Jennifer practiced meditation and relaxation techniques to lower her stress level, and Barbara joined a ballroom dancing class for both the physical activity and social interaction.

Creating Support Systems

The most frequently used protective factor to counteract stressors was the relational support system. According to previous research on RCT, Miller et al. (2004) laid the

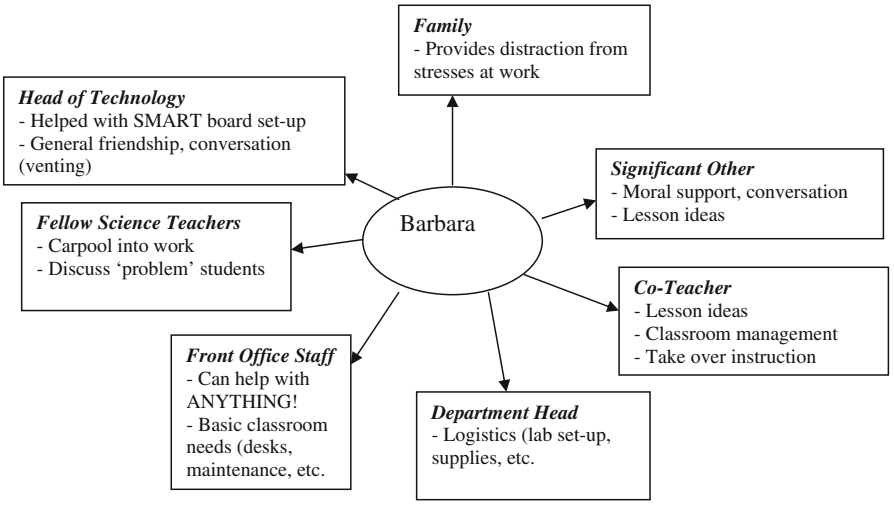

Fig. 2 Barbara, first year of teaching

groundwork for expanding the notion of connections for individual development from a clinical context into other arenas, encouraging a sense of worth and a desire for more connections. Building on this premise, the notion of relational connections became an integral piece of the framework upon which assumptions were made in this study.

Each participant built growth-fostering empathic relationships as evidenced by their relational maps, interviews, classroom observations, and work shadowing conducted throughout the 2 years. The following comment was made during an interview conducted in one participant's first year of teaching. This comment underpins the notion of the necessity for support systems.

> Year 1, Linda- During your first year you need a whole bunch of different people helping you…Well, someone that has been teaching for a long time, someone that has been teaching for a short time, someone that teaches your subject, someone that teaches another subject. Just to give you different ideas about different things. You want to find yourself as a teacher and not just become a clone of another teacher (Interview #3)

For Sara, Linda, Barbara, and Jennifer, support systems consisted of co-workers, family, friends, and others. Each support was chosen to match the type and degree of the particular adversity encountered. This is exemplified in Figs. 2 and 3. Note that individuals in the support system changed as well as the shape of Barbara's relational maps; circular to linear, lending support to the notion that resilience is relative, developmental, and dynamic (Gu and Day 2007; Luthar et al. 2000) and that resilient individuals are able to match protective factors to changing stressors in both type and degree of emphasis. Findings reveal that it is both the style and the content of coping that makes the difference (Pearlin and Schooler 1978).

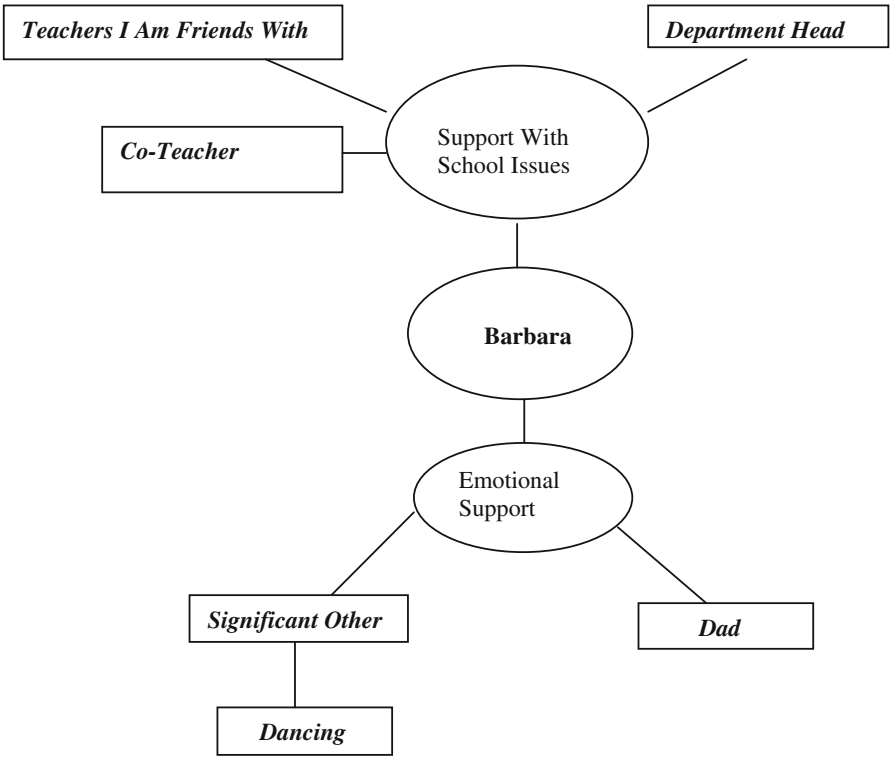

Fig. 3 Barbara, second year of teaching

Risk factors refer to an event or experience that can be expected to cause stress in many people. It carries the potential for interfering with normal functioning (Masten 1994). For teachers, stress is the result of a complex web of interacting factors. Findings revealed nine stressors encountered by the four novice teachers, which led to negative outcomes and resulted in stress. Interactions between stressors and their protective counterparts were noted to be personal, professional, and contextual in nature. These labels were also used to categorize the stressors experienced by the four participants. Personal stressors included family strains brought on by illness, marriage difficulties, and feelings of isolation. All four participants indicated that taking care of family needs and meeting career demands created stress. Yet, each individual handled that stress differently, calling upon various combinations of support systems, physical activity, and direct action to alleviate the stress. No two participants had the same combination of protective factors, nor the same degree with which they applied those protections to the stress. For example, Linda became pregnant with her second child during her second year of teaching. A difficult pregnancy forced her to take an early maternity leave. She experienced stress in trying to organize and maintain the remainder of the academic year for a substitute teacher and managing her health problems. She relied on her fellow science teachers as her support system for dealing with school issues and her family, friends, and doctor to help with health concerns and family needs.

In addition to the pull between family needs and career, participants indicated that professional stressors such as taking on extra-curricular activities, having multiple courses to teach and feeling the loss of control over personal time also created stress. For example, all participants were expected to take on extra-curricular activities. Sara and Jennifer coached cheerleading and dance teams. Barbara coached a Science Olympiad team, and Linda was involved in writing and managing grants that included partnering with a local community college. Each activity required the novice teachers to donate both after school time and in some instances, their weekends for the duration of the season. During the first year of teaching, taking on the extra-curricular activities was considered manageable because they had only one preparation. However, in their second year, all participants were teaching multiple courses in addition to continuing with the extra-curricular activities. In some instances, those preparations included teaching a content area that was unfamiliar to them. The combination of extra-curricular activities, multiple course preparations, and perceived lack of control over their personal time led to a more stressful second year than during their first year of teaching. Jennifer summed it up during interview #5, "All the extra crap [referring to extra-curricular activities] that they make you do. That stresses me out. I feel like I can't get my grading done because I have this practice or this club."

The second year of teaching also gave rise to contextual stressors, which included turnovers in administration and faculty. Barbara taught in a school experiencing a high turnover rate in administration. With each administrative change came changes in school protocol and management styles. This situation led to confusion and a feeling of helplessness in the ability to control the decision-making process that directly affected her. Sara and Jennifer experienced concern with a turnover in administration directly following a year of arduous meetings to create the Freshman Academy, a school within a school philosophy. Central to the decision-making process was input from teachers and administrators. Change in administration brought skepticism and uncertainty as to follow through of plans forged with the previous administration. Table 4 is a summary of the themes that emerged during cross-case analysis for each participant. Column three describes both internal and external negative influences that gave rise to those themes.

Discussion and Conclusion

Resilience Theory and Relational Culture Theory are essential to the understanding of the resilience construct and to the framework upon which this research is built. Cross-case analysis provided the primary themes of stressors and protective factors for the development of the resilience framework and in answering the primary questions posited in the introduction of this paper: How is resilience developed in novice secondary science teachers and how does resilience effect novice teacher retention?

How is Resilience Developed in Novice Secondary Science Teachers?

Findings central to the resilience framework supported the notion that the interactions between stressors and protective factors constitute the driving force

Table 4 Themes

Participant	Themes	Conditions that gave rise to themes
Sara	1. Over commitment	1a. School need for teachers to volunteer for extra-curricular activities
		1b. Changes in personal life demanding more time
	2. Conflicted emotions	2a. Type "A" personality aiming for perfection
		2b. Uncomfortable with change
		2c. Need to feel supported and appreciated by administration and parents
	3. Fragile balance between teaching demands and teaching enjoyment	3a. Struggle between personal and professional life
		3b. Need for a helpful support system
Barbara	1. School culture	1a. Lives outside of school district with no experience teaching in black community
		1b. High turnover rate for both teachers and administrators
	2. Balance between stress and enjoyment difficult to maintain	2a. Inexperience working with high needs students
		2b. Little to no support systems in place due in part to high turnover rates
Linda	1. History with the school	1a. Three generations of family in school community
		1b. Lives in school community
		1c. Familiar with school faculty, administrators, and school protocol
	2. Broad science background	2. Wide range of science content experiences both in education and in business
	3. Focus on the students	3. Frequent self-reflection to improve lesson delivery and student rapport
Jennifer	1. Hardiness	1a. Personality open to change
		1b. Certified to teach ESOL classes
	2. Challenges	2a. Not organized especially with required paper work
		2b. Struggle to balance a family illness with teaching demands

of the resilience process and stimulate responses to help counteract negative effects of stress. Linkages established between the stress and protective factors provided the pathway for understanding how resilience is individually fostered. Without stress, the resilience building process cannot occur. Each stressful encounter provides an opportunity to access protective factors and build resilience as noted in Fig. 1. This research posits that stressors and protective factors not only facilitate the process that builds resilience, but also is necessary for the process to take place. The contribution of this study to the understanding of the resilience building process in novice secondary science teachers comes as a result of acknowledging the following findings on how resilience developed in the novice secondary science teachers:

- Individuals are considered resilient only if there has been a significant threat to their development. The participants must have encountered current or past stressors in order for the building process to take place.
- The four participants encountered personal, contextual, and professional stressors that changed between their first and second year of teaching. It is reasonable to assume that circumstances change over time. Therefore, stressors associated with those changing circumstances also change in both type and degree of resulting stress for the participants.
- Protective factors also changed in accordance with the changing stressors between year one and year two of the participants' initial teaching years. The process framework indicates that negative outcomes are moderated by protective factors, and therefore, those protective factors must change in type and degree to counteract new stressors and resulting stress. It is logical to assume, therefore, that the resilience process in the four participants was flexible, ongoing, and recurrent.
- The interaction between stressors and protective factors acts as a primary force in the resilience process and stimulate responses to help counteract negative effects of stress, thereby building resilience in novice secondary science teachers.

How does Resilience Effect Novice Teacher Retention?

Underlying the success of the four novice teachers in this study is the notion that their resilience stems from their ability to revise protective factors in order to address changing stressors. These conclusions are similar to those of Pearlin and Schooler (1978), which suggest that continuous and varied experiences provide a teacher with a greater repertoire of coping mechanisms. Cross-case analysis revealed that resilience in the four participants was flexible, ongoing and recurrent, and the cycle of stressors, protective factors, and the building of resilience were closely allied with the participant's recovery of strength in the face of adversity. This strength which stemmed from repeated interactions between stressors and protective factors led to an increased ability to use problem-solving strategies as well as maintain self-efficacy and a sense of humor.

Managing interaction between personal, professional, and contextual identities was a complicated process for Sara, Jennifer and Linda but one, which contributed to their resilience building. A condition, according to Gu and Day (2007), that is necessary for teacher retention. It can, therefore, be concluded that each of the four cases studied in this research indicates that using individual skills to recover from adversity and building strong and varied relationships were a motivating force in overcoming stressors encountered by the novice teachers and contributed to building resilience. It can also be concluded that building resilience can directly contribute to teacher retention (Tait 2008).

Implications for Novice Teachers and Science Teacher Education

Given these circumstances, helping pre-service and novice teachers to understand and embrace, the resilience process can indeed foster teacher retention. Resilience is

a process that happens over time. To embrace this process, gives rise to a commitment on the part of the novice teacher to understand both the process and the continuous expansion of self-conceptualization with the understanding that the sense of self emerges and changes primarily in relationship to others (Mahoney and Granvold 2005; Jordan 2004). The four secondary science teachers in this study embraced the notion that life and human consciousness is not static, but rather is a continuous process (Mahoney and Granvold 2005) with the understanding that relationships are at the core of resilience (Jordan 2004). Building their resilience and relational connections were key components in their decision to remain in the profession.

Research suggests that some time-tested advice offered by science teacher educators, administrators, and induction programs may need to adjust to the realities of what is happening in the field. Changes in advice to pre-service teachers should include information on changing risk factors that novice teachers are likely to incur during their initial years of teaching and ways to employ appropriate protective factors that will counteract the resulting stress.

The findings also suggest that novice secondary science teachers attempting to address the risk factors associated with their initial years of teaching will need support in the form of empathic relationships if they are to successfully contend with the personal and professional demands of teaching. It is further implied that:

- Science teacher educators should structure methods courses that consider individual skills such as good communication skills and collaboration strategies as an integral component of the preparation of teachers. The learning environment should encourage pre-service teachers to form support systems that are comprised of reciprocal learning relationships both inside and outside of school, early in their career. Pre-service teachers should also be made aware of possible risk factors they may encounter as novice teachers and encouraged to construct protective factors to counteract those risks.
- Strategies for matching appropriate protective factors with risk factors can be taught in methods, classes, professional development during the initial years of teaching or during department meetings. Strategies include the use of direct action and/or palliative action when dealing with stress. Direct action attempts to change the situation that is causing stress as seen in the situation when the novice teachers spoke directly with administrators. Palliative action attempts to control the stress through relaxation techniques, taking on new hobbies or joining in sports activities.
- School schedules can be organized in a way that would promote protective factors such as the formation of support systems and the promotion of individual skills that counteract exposure to adversities.
- Induction programs should offer professional development opportunities that highlight the process framework for building resilience.

Current research suggests that resilience building may play an integral part in keeping novice teachers in the profession. Data from this research indicated that all four teachers in this study exhibited resilient traits. As of the writing of this article, all four participants are in their fourth year of teaching. Two have changed schools but are

still teaching high school science; two have remained in the school in which they started. Participant 2 summed up resilience and teacher retention with these words*: Well I think if I were not resilient this year would have done me in for sure (Interview #6 at the end of the 2nd year)*. During recent e-mail exchanges, the participants indicated that they still relied heavily on their support systems to see them through difficult periods. Although their personal, professional, and contextual lives have taken many different turns, they have chosen to stay in the teaching profession.

Credibility, Limitations, Future Research

Credibility of this study is derived from the multiple sources of data and length of the study. Specifically, the researcher used in-depth, semi-structured interviews to collect data over a two-year period. This allowed the researcher to enter novice teacher's personal, professional, and contextual life in order to understand their response to change. Other data were derived from observations conducted during work shadowing to observe the participants in their natural surroundings to gain insight into their working lives, written prompt to elicit metaphors for personal resilience, and requests to construct relational maps which depicted changes to support during their initial years of teaching.

Limitations are found in three areas: the first is found in the small sampling of teachers. Only four teachers were followed for a two-year period. The second limitation is that all teachers are a single gender. Although that was not a criterion for choosing the participants, no male teachers were a part of the research. The third is the limited context in which the participants were situated. Urban schools were not a part of this study, and only one rural school was included.

There is a need for future studies to focus specifically on interactions that occur between changing stressors and protective factors in order to determine the effect on the resilience process. Is having a support system more important than having individual skills, are they equal in value, are there other protective factors, does this process apply to only novice science teachers? These are only a few of the questions that need further research. In addition, replication of this study should include a larger sample of teachers over a longer period of time and teaching in a variety of settings. Longitudinal studies with more science teachers would allow the researcher to focus on the process of resilience at different points in time throughout the academic school year. Research can further address issues concerning stressors and protective factors in suburban, rural, and urban school settings with teachers of both genders with varying years of teaching experience. Clearly, there is much work to be done in the area of building resilience in novice teachers.

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