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Exploration of science teacher identity construction through various lived experiences

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Abstract: Identity is the construction of interpretations of life experiences in certain contexts, resulting in self-understanding. This research, with a single case study design, aims to explore the identity of science teachers in various contexts of Figured Worlds. The research participant is a science teacher named Yuni (pseudonym), who has a background in Physics Education. Data were collected through two semi-structured interviews. The results revealed how Yuni interpreted science-related life experiences in Figured Worlds to construct her identity. The researchers concluded that although, throughout Yuni's experience, she was not interested in becoming a teacher, she was able to become an outstanding teacher through her scientific papers.
Keywords: figured worlds; lived experiences; science teacher identity

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Introduction

Learning in various disciplines, including science, has been directed towards reformative learning. This is done to strive for active and interesting learning. The decision to choose the learning strategy to be used is not only influenced by the knowledge and skills possessed (Keiler, 2018). Teachers have guidelines that influence their profession and teaching style. This describes the characteristics and labels that a teacher attaches to himself that guide him in making his learning decisions. This is explained by the identity perspective.

In recent years, there has been attention paid to teachers themselves, who they are, and how teachers perceive identity in relation to teacher reform and education (Chung-Parsons & Bailey, 2019). Teacher identity, which shapes teachers' attitudes, beliefs, and practices related to who they are, is fluid and evolving (Avraamidou, 2019). Factors that influence teacher identity are personal, professional, historical, and cultural (Hanna et al., 2019). This is in line with previous researchers, who defined professional identity as a process of continuous integration of professional and personal aspects (Purwaningsih et al., 2020). Although identity is an individual construct, broader social interactions influence identity development. This is because teacher identity is a construction of the interpretation of experiences in a particular context that results in a multi-faceted self-understanding (Avraamidou, 2014a). Therefore, experience is important in the formation of a teacher's identity. These experiences are science and learning experiences.

The construction of science teacher identity through lived experiences provides a clear example of how teacher identity develops. The results of the study show that teachers' decisions to use reformative learning for science learning practices are largely determined by their college learning experiences (Wei et al., 2021). Other research shows how the experience of activities outside of

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lectures significantly affects teacher identity (Purwaningsih et al., 2020). This means that a lack of understanding of science teacher identity will lead to a lack of understanding of the roles and challenges that teachers must face. For example, the selection of appropriate science learning practice approaches and an in-depth understanding of science concepts So that this will affect the quality of science teaching in the classroom.

Several studies have revealed how experiences influence teacher identity. Researchers have discussed how the teaching experience of international guest lecturers affects personal, professional, and intercultural development (Ospina & Medina, 2020). Others had discussed how pre-service subject teachers interpret failure and how it relates to teacher identity (Lutovac & Assunção Flores, 2021). Several studies on science teacher identity in Indonesia have been conducted. Researchers had uncovered the hidden power of personal identity in the lived experience as a teacher of a science teacher teaching in Indonesia and Australia (Rahmawati & Taylor, 2018). Another researcher uncovered the development of a physics teacher's physics identity through specific instructional practices designed to incorporate the use of multi-representation (Munfaridah et al., 2022). Other researchers have also explored the identity of student teachers in the context of physics teacher preparation programs in Indonesia (Purwaningsih et al., 2020). However, research in Indonesia on the construction of science teacher identity is still a new concern. This can be seen from the very few studies on the identity of science teachers, especially in physics.

A review study on science teacher identity argues that there is a knowledge base regarding approaches and interventions that might support science teachers in their identity development during teacher preparation and professional development (Avraamidou, 2014a). However, this still does not reveal an understanding of science teachers' identity development. For example, during school and into teacher preparation Therefore, this study adds to the existing knowledge base on science teacher identity and addresses two gaps in the literature: (a) the number of studies on the identity of science teachers, especially physics teachers, is very limited; (b) there are still few studies that focus on the development of science teachers' identities throughout their lives.

Therefore, this study was conducted to uncover how science identity develops through time and across contexts. This was revealed through life experiences. This research used a framework where the science teacher identity is composed of different figurative worlds, including family/childhood, school, out-of-school, university, science, and professional experiences. Different experiences in different figurative Worlds are interconnected and affect teacher identity (Avraamidou, 2019). This framework can reveal how experiences in specific contexts can influence teacher identity.

The purpose of this study is to uncover the events and life experiences of a science teacher that are important for the development of her science identity. Identity is conceptualized as life experiences that are shaped in various contexts, particularly in the process of becoming a science teacher. The specific aim of this study is to explore how science teachers make meaning of science experiences from childhood to their professional lives.

Method

This research studied science teacher identity using a qualitative case study design. This design can describe and analyze a system in depth (Edmonds & Kennedy, 2017). This research was designed as a single case study. This is because the researchers believed that teacher identity is complex. This single case study allowed the researchers to explore one science teacher. It also provided in-depth information about science teacher identity.

The research was conducted in a public junior high school in Pasuruan in the first semester of 2022–2023. The research participants were selected using the purposive sampling technique. This was done to obtain a sample that was in accordance with the research objectives. The science teacher who became a participant was Yuni (pseudonym). Yuni is a professional science teacher who has a background in Physics Education. She was chosen because she was considered an information-rich case. First, Yuni won the INOBEL national scientific work competition in 2014. Since then, Yuni has continued to be actively involved in scientific work as a writer and advisor. Second, Yuni continued her master's

degree in physics education program in 2012 with a scholarship. Third, Yuni has social media accounts (Facebook and YouTube) that are actively used to share science learning activities. Fourth, Yuni is actively involved in innovating science learning applications (the ZGrade question analysis application). Fifth, apart from being a science subject teacher, Yuni also acts as part of the Curriculum and is active in the MGMP (Musyawarah Guru Mata Pelajaran) science teacher organization. The reason for choosing an outstanding and active science teacher is because it is believed to illustrate how achievement is obtained. This will be useful in understanding teachers' identities towards science and science teaching. The researcher assumed that Yuni's characteristics could answer the research question, although they could not be generalized. The research flow is pictured in Figure 1.

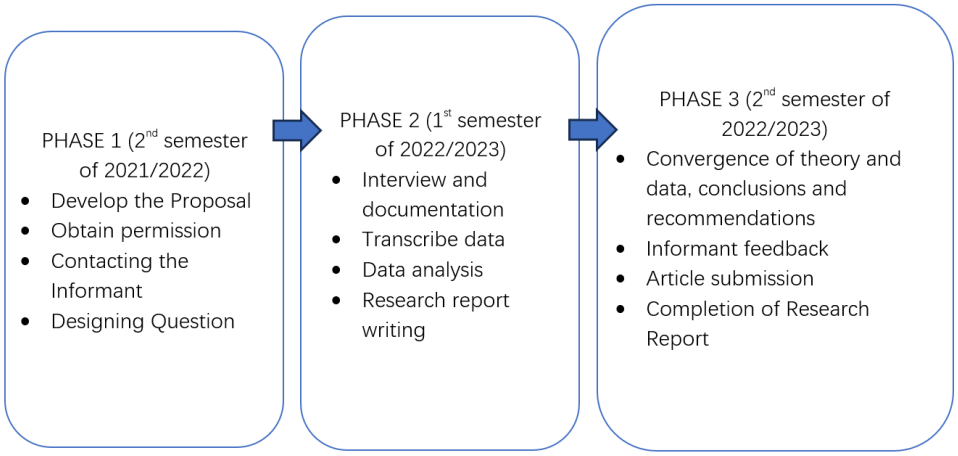

Figure 1. Research Flow

The instrument used in this study was an interview guideline. The interview guideline was used two different times. The interview guidelines contained open-ended questions regarding: (1) past science learning experiences (childhood, elementary school, junior high school, high school, and university) and science experiences outside school; (2) beliefs and perceptions about science and its learning; and (3) her professional learning practice experiences. The interview guidelines were validated by an expert lecturer. She is a Professor of Physics Education with research focusing on professional teacher development, including pedagogical content knowledge and teacher identity.

The data were collected through semi-structured interviews and audio documentation. The interviews were conducted twice, with a total duration of 2 hours, 28 minutes. The first step in data analysis was to transcribe the interviews. The second stage was the experiences that influence teacher identity were narrated based on the context of each figure-world, namely childhood/family, schooling, out-of-school, university, science, and professional experience. This shows how a science teacher interprets her life experiences in various Figured-World contexts to form her teacher identity.

Results and Discussion

Yuni is an experienced science teacher with a background in Physics Education at SMP Negeri Pasuruan. She is positioning herself positively towards science and has a keen interest in the Laboratory.

Figured Worlds of Childhood or Family

When sharing her personal story with her family, Yuni emphasized how her family greatly influenced her learning. Since childhood, Yuni has been forced to be the best in class. This was due to her family's underprivileged background. The goal was to get a scholarship at the most popular public junior high school at the time. The pressure to be the best in class caused her to have negative feelings towards learning. Her health was affected by this, such as when she had a fever every time there was an exam at school. However, this did not make Yuni give up on her studies. Despite the pressure, Yuni's family still provided help and support.

Yuni admits that her interest in science is strongly influenced by her family. Her first and second brothers are math teachers; her third brother is an elementary school teacher; and her fourth brother was a biology student. According to her, the experience of learning science with her older siblings was more effective, so her science grades excelled. Yuni again emphasized her family's influences on her learning. This is important because it shows how the nuclear family is an important factor in the development of a strong scientific identity.

Yuni again emphasized her family's influences on her learning and future decisions in high school. Yuni shared that her family's opinions were divided. Her siblings pressured her to go to university to study science, while her father did not allow her to do so due to financial constraints. Yuni said that she did not like teaching, preferring to work in a factory or laboratory, but her brother was against it. Yuni admitted that, because of this, her passion for learning during high school was only half. Yuni then decided she wanted to become a chemistry teacher, but her brother opposed it again.

Yuni tells the story of how she came to choose physics education as her major. When she was taking her exams, her father made it clear that he could not afford to send her to university. The next day, her four older siblings came home to discuss Finally, it was decided in the discussion that Yuni would study physics education, with the costs shared by the siblings. After that, Yuni received money for registration and examination fees and was accepted by the State University in Jember.

Yuni said that she had asked her father for money to register for a polytechnic in Malang majoring in chemical engineering because, at that time, Yuni was still not interested in studying physics. Yuni said she did not want to be a teacher because she was more interested in being a laboratory assistant. But her brother forbade her because the graduates would work in factories. Finally, Yuni gave in and studied physics in Jember.

Figured Worlds shows how traditional family culture may have influenced Yuni's teacher identity. First, Yuni's relationship with her family Despite her difficult economic situation, her siblings gathered, discussed together, and supported Yuni's education. The relationship between her family members shows that although family members are separated because they have their own families, her siblings still maintain a close emotional relationship with the family. This shows how family traditions can influence girls' identity formation (Avraamidou, 2020). Cultural philosophical values provide a moral basis for people's lives (Rahmawati & Taylor, 2018; Sarsito, 2006). The relationship between Yuni and her family shows how they position themselves in relationships among family members.

Second, due to gender stereotypes and family capital, Yuni's older brother forbade her, a girl, from majoring in engineering because the graduates would work in factories. This refers to what a girl can do. Despite Yuni's efforts to fight this stereotype and decide her own future by secretly enrolling in chemical engineering, Yuni eventually gave in.

In addition to gender, this experience also shows how Yuni's cultural background influences her future decisions. Traditionally, women are expected to obey what men say (Rahmawati & Taylor, 2018). This influences Yuni's thoughts and actions as a girl.

Figured Worlds of Schooling

Yuni shared her experience of learning science in junior high school. Yuni said that the Biology Lab at that time had all the preserved worms and original human skulls donated from the State University for learning. Because of this, Yuni became fond of learning biology. First, the curriculum, facilities, and teacher practices provided opportunities for students to learn by connecting science with real-life examples. This resulted in a clearer interest in science. Second, the experience of learning science described with the word 'like' supports Yuni's emotional state as a learner (Avraamidou, 2019). This positive description is the result of the experience of being active in a science learning activity. This experience resulted in great emotional support and influence on Yuni as a science teacher. This is evidenced by her desire to implement the same Biology Laboratoty.

In 2008, Yuni tried to convey to the Vice Principal about preserving living things, which was responded positively. Eventually, the school purchased cobras, jellyfish, fish, starfish, and scorpions for

preservation. During the animal classification lesson, the preservation jars were shown to the students. Yuni thinks this makes students happier and more understandable than just showing pictures.

Many interesting things can be noted. First, Yuni emphasized that active science learning practices make students happy. The emphasis on the word 'happy' can be traced back to Yuni's previous science learning experiences and shows Yuni's attention to how emotions affect her students' learning. This is in line with research that states that emotions influence science teaching by teachers (Maulucci, 2013). Second, how Yuni uses real-life examples in her science learning practices, as she experienced them as a science learner. This is important because it provides evidence that various experiences throughout a teacher's life are rational, intersect, and influence a teacher's scientific development (Usman et al., 2021).

The above experience was different in the high school situation. Yuni emphasized once again how much she liked the laboratory. However, the laboratory in high school was not so good, so practicum was rare. Yuni said that of the science subjects at that time, chemistry was her favorite because of the lab work. This provides evidence that Yuni is a learner who likes to be actively involved in scientific activities such as lab work. Despite this experience, Yuni did not lose interest in science, but she distilled this experience for her own future reasoning. This is demonstrated by Yuni's science learning practices. Yuni said that a lot of her current learning practice is done in the laboratory. Yuni argues that learning in the laboratory does not need to lift things, and there are more facilities (sound and projectors), so students are happy.

Several things can be noted from this experience. First, Yuni emphasized that she has a great interest in working like a scientist. The emotion of liking chemistry more because there are more labs shows that learning with lab methods makes her feel like a scientist (Avraamidou, 2019). This has strengthened her sense of self as a science learner. Second, the science learning practices that Yuni used more in the laboratory showed that the facilities and teacher practices provided opportunities for students to engage in active science learning.

Figured Worlds of University

In this Figured World, Yuni told how she studies as a physics student. In the first semester, Yuni admitted that the grades of physics courses were more dominant than those of education courses; education grades were good because Education lecturers were kind. Yuni also claimed to be weak in quantum and electronics courses. Yuni admitted that at that time she still disliked physics and becoming a teacher. This is interesting because it contrasts with her learning results, which are dominant in physics courses rather than Education. This shows how Yuni, as a science student at the university, despite her lack of interest in what she was learning, was still confident in her personal science knowledge.

In Figured Worlds, Yuni did not talk much about her physics learning experience in class; her time was mostly used for organizational and outside activities. Yuni described her classroom learning with the word 'ordinary' without any other stories related to physics material, learning practices, or lecturers who teach. This proved Yuni's earlier statement that she still does not like physics, so she is less interested in what happens in her class.

Yuni's learning experience at the university shows how complex identities develop. A key aim of teacher education is to encourage prospective teachers to think deeply about teaching and learning (Buchanan & Olsen, 2018). However, even if a science learning program is designed in such a way, it may not be effective if there is no interest or engagement from the learners.

Figured Worlds of Out-of-School

Yuni is the youngest of five children. The learning resources used at that time, in addition to the books that were required to be purchased by the school, were also obtained from her uncle's personal library. Yuni's uncle at that time was the principal of an elementary school, so he had many books. Yuni read all the books owned by her uncle, even though the books were not for elementary school children but teachers' books and college books. In addition, Yuni also liked to read her brother's biology

textbooks at that time. This built more personal science knowledge. Yuni had a family situation that gave her the opportunity to explore science outside of school through the books she read.

At university, Yuni joined four organizations simultaneously: HIMAFI, Prisma is a writing organization, ElemenD is an external organization, and the theater, which is in the literature department. Yuni shared her memories of being a member of the literature faculty theater. Yuni participated as a scenario writer and stage manager. Yuni admits that this affects the way she presents material or dialogues in class. Sometimes Yuni changes her way of speaking, dialogue, and even her accent in class to entertain her students. This experience gave her the confidence to socialize. When looking at school life, Yuni always describes herself as an insecure learner. However, when at university, organizational activities gave Yuni the opportunity to develop her personal identity and build relationships.

At the end of her college years, Yuni worked as a tutor and in customer service at a Learning Education Institution (LBB). Every early month at the LBB, Yuni received guidance in the form of microteaching with tutors from other LBBs. Although there was no improvement in physics material skills, Yuni admitted that her science learning practices improved more when she became a tutor than when she studied in college.

When tracing her learning experience at the university, Yuni was still not interested in teaching physics. However, Yuni worked at LBB, where she had to provide material to students through teaching practice. This experience shows how the reconstruction of science teacher identity towards science teaching becomes more positive (Avraamidou, 2016a). When viewed from Yuni's perspective, who likes active learning with real examples, Teaching practice as a teacher gave Yuni the opportunity to deal directly with students. So that it affects her views on the science teaching profession.

Yuni's experiences outside of school affected her science teacher identity development. Although there are experiences that are not related to science, they have an impact because they provide an innovative view of science teaching (Avraamidou, 2019). This is in line with the statement that informal learning experiences can influence one's identity (Close et al., 2016; Wulff et al., 2018).

Figured Worlds of Science

Yuni argued that science learning should ideally have all the materials at home and in each student's environment, so that it is contextualized. Second, there is a tutor. Yuni argued that students who have tutors will be better prepared because there is someone to teach them. The third is family support. Yuni believes that children who have the full support of their parents as students can run their school well.

Sharing the description above can show that Yuni is a teacher who always strives for her students to learn contextual science. This can be traced to her science learning experience and family background. Yuni has a positive impression of learning science with the practicum method. Yuni, as a student, gets a lot of help from her family to learn. Therefore, she wants her students to also learn science actively and contextually, accompanied by assistance and support. This shows that Yuni believes science learning should be done through student-centered inquiry. This is one aspect of the reform-oriented approach (Avraamidou, 2014b). This means that it is possible for Yuni to develop into a reform-oriented science teacher in the future.

Figured Worlds of Professional Experience

In These Figured Worlds, Yuni talked about some of her most memorable science learning practices. Yuni likes science learning practices with practical methods, or at least demonstrations. First, the material at that time was mixture separation. Students competed to make the river in front of the school clear. Yuni asked students to bring their own practicum materials.

Second, when the material is ingenious, Yuni tried at home using 14 kg of plastic with plants at home instead of hydrila. This was done to simplify the tools that could be brought to school because practicum tools and materials are usually charged to students. After trying, the practicum was successful and could be observed. Third, the chromatography material Yuni used round filter paper

with arbitrary dot locations and various colors. This would produce more diverse data that can be analyzed by students. These three lessons were then submitted to a national seminar entitled Nature Practicum." The practicum used tools and materials that were in the environment and can be applied.

Several things can be noted in the professional experience of the science teacher above. First, her fondness for science practicals made Yuni chose the practicum method for her science learning practices. This is in line with the statement that the teacher's identity can guide her in making pedagogical decisions in the classroom (Chen & Mensah, 2018). Second, Yuni strives for practicum with simple tools and materials that can be found in the school environment. This is in line with the statement that identity plays a role in helping teachers decide on the type of technology that is suitable for use during learning (Badia & Iglesias, 2019). Third, the skills gained from participating in scientific writing organizations during college support Yuni's professional identity as a science teacher.

Yuni said that she started participating in the paper competition because she was forced to. In 2008, when Yuni was just appointed as a civil servant, MGMP forced her to participate in the INOBEL competition without knowing the technical instructions of the competition. In 2014, after graduating from her master's program, she revised her thesis, entered it, and won. Yuni admitted that she was enthusiastic about participating in competitions and events because people only knew that Yuni won many competitions, but behind that, she also lost more.

The above experience can show how Yuni, as a science teacher, faces failure. Failure shapes the identity of future-oriented teachers (Lutovac & Assunção Flores, 2021). This shows that a person has a growth mindset if they see that success depends on the effort invested and that setbacks are opportunities to learn.

When she was a teacher at her current school, Yuni referred to herself as the perpetual teacher of grade 7. This was because, since becoming a civil servant, she often traveled out of town for several days. Yuni felt that her students were not handled properly. Yuni also admitted that her weakness as a teacher is getting to know her students. In addition, despite being an outstanding teacher, Yuni still does not feel that she is a capable teacher.

The above experience shows how many roles teachers have at school. When teachers carry out learning practices, they have three functions: instructional functions, educational functions, and management functions (Abida Ferindistika Putri et al., 2019). These multiple roles allow the formation of ideal conflicts, namely when one identity is different from another. Adaptation and adjustment to teacher identity can be difficult. This conflict can be called a dilemma, meaning a conflict situation that requires a choice because it competes (Christensen, 2019). This dilemma can affect learning practices and even personal identity.

Science Teacher Identity and Its Implications

Yuni shows how she positions herself positively toward science. This can be traced from her love for science across her experiences. Yuni also shows that she is a teacher who does not give up and continues to improve. This can be proven by her attitude toward accepting defeat in the competition and continuing to try the next one. In addition, Yuni tries to provide important scientific values in her science learning practices. The impact is that Yuni tries to provide science learning through an inquiry approach. Establishing a positive learning atmosphere and interaction style in the classroom is an important role for the teacher (Alles et al., 2019). Positive attitudes and positions towards science and science learning will influence the learning experiences of their students. According to previous research, high levels and types of student engagement are influenced by the teacher's position (Hazari et al., 2015). This means that understanding the position of physics teachers through their identities will help teachers design relevant and interesting physics learning for students.

Yuni's science teacher identity shows that Yuni is a teacher with an interest in inquiry and contextual science learning. This can be traced through her science learning experiences as a student and her science learning practices in the classroom. What is interesting is how this is not influenced by her physics learning experience at university. Researchers suggest that teacher education programs are the starting point for instilling the need for identity development (Beauchamp & Thomas, 2009).

However, in Yuni's experience, the teacher identity did not develop because Yuni had no interest in the teaching job and no interest in physics. Therefore, this finding shows how important the emotional domain is in the formation of teacher identity. Based on Yuni's case, there is an argument for the important role of teacher preparation in supporting physics teachers who are still developing their physics teaching identity (Avraamidou, 2014b, 2016b; Zangori & Forbes, 2013). This also refers to research recommendations for effective teacher preparation programs that support physical teacher identity development.

Although Yuni is an experienced science teacher, she still has weaknesses and areas that need to be continuously developed as a science teacher. This is in line with research that states that the development of science teacher identity will continue throughout the teacher's career (Avraamidou, 2019; Hong et al., 2017; Saka et al., 2013). This means that understanding science teacher identity is an important part of teachers' continuous professional development. Science teachers can identify strengths, weaknesses, and improvements in their students science learning.

Conclusion

This study aims to explore the construction of the science teacher identity of Yuni, a physics teacher who teaches science subjects in junior high school. Therefore, this study explores Yuni's life experiences from various Figured World contexts, namely: family/childhood, school, out-of-school, university, science, and professional experiences. Yuni's science teacher identity is formed and continues to develop throughout her professional life.

Based on the construction of Yuni's identity in various Figure Worlds, it shows that Yuni is an outstanding teacher through her scientific papers and innovations, even though, throughout Yuni's experiences, being a teacher was not her interest. There are several things that can explain this based on her experiences. First, Yuni positioned herself positively toward science across her identity. This makes her a teacher who understands the importance of teaching science with inquiry, context, and experimentation. This identity is constructed from Yuni's various science learning experiences during school, which gave rise to her interest in scientists and their work.

Second, Yuni's personal identity is ambitious and unyielding. This identity is influenced by her family. Her difficult family background made her have to be the best student. Although there were negative feelings due to the pressure, her family provided financial support and learning assistance. Third, out-of-school experiences contributed to making Yuni a teacher with a creative outlook on science learning. This can be seen in how Yuni developed her pedagogic skills and writing through out-of-school activities.

This study involved only one participant and is not intended to generalize the findings. However, this study was used as a preliminary report in the exploration of teachers' science identities with one participant. Therefore, future research could involve more participants and gain a greater variety of experiences to explain more about teacher identity development.

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