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What Supports Out-of-School Engagement?

Transformative experiences (TEs) are a form of out-of-school engagement where students engage in free-choice transfer of science concepts to everyday settings in ways they find meaningful [1]. This research contributes to an understanding of how TEs are supported by identifying distinct sources of the student's experiences. We examine three cases of TE that were supported in different ways, highlighting aspects of the cases that relate to factors identified by research as supporting TE, including students' science identity and course pedagogy [2]

Data Selection for Three Cases

Sources of Data:

- Quantitative and qualitative survey data
- One-on-one interviews with students

Selection of Data:

- Undergraduate students enrolled in physics or physical science courses took both TE survey [3] and participated in an interview (N=14)
- Selections of those with high levels of out-of-school engagement indicated by TE survey.
- Three selected for cross-case analysis [4] based on *inherent interest* and *contrastive value*

Conclusions

These cases capture a variety of ways that TE can take shape and be supported. Robert's science identity supported him having TEs across multiple topics and courses that were aligned with his careers goals. Madison's particular experience learning in a class through discourse and questioning supported her in having science discussion at home with family. Harrison's idiosyncratic interest and curiosity in a particular topic supported him in noticing examples in his everyday life despite disliking his physics course generally. While identity, pedagogy, and topical interest played significant roles in at least one case, they played marginal roles in others.

References

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Transformative Experiences are Supported in Different Ways

Science Identity Supports Robert's TE

As chemistry/physics double major, Robert has career aspirations in academic research. A strong science identity and mastery learning orientation fuel his study habits, social context, and engagement with science.

"I intentionally surround myself with people like that –people who really want to understand things—and I want to surround myself with people with common goals so we can all discuss."

"If I feel like I need extra help I'll refer to something like Khan Academy or an online source... I'll take, if there is like a sample test at the end of the chapter, I'll take that test and see what all I missed, go back to the section of the book that that's in and see if I can get a more in-depth understanding. Write down as many minute details as possible, because I like a very fundamental understanding of things."

Pedagogy Supports Madison's TE

As an elementary education major, Madison did not have strong interest in science, but her experience learning in class with peers made her more interested.

"Not [interested] as much as I am now. ... Now when I see something, I question it. And before, you know, you may just kind of question it a little bit, or why is it working and just walk away. But now, I have to know, why those colors are there, [etc.]"

"The way this course was taught got me interested in the topic, not just interested in retaining the information for a good grade...I wanted to be in class and listen to what everyone else was thinking. ... Others wanted to hear my ideas just as much as I wanted to hear theirs..."

Topical Interest Supports Harrison's TE

Physics was Harrison's least favorite class, but his fascination with optics and the nature of light to allow him to change how he sees and interacts with the world around him.

"I feel as though [the instructor] lectures too long, when we have the [readings] available to us. We spend less time doing physics than him—listening to him talk about physics. And I would much prefer to learn physics by doing it rather than having a repeat of [what] I just read."

"Since I was a kid, you know, I had all these questions. Well how come if you walk in front of this mirror and you look like your face is this wide, and you walk in front of another one and you're ten feet tall. So, now that I have learned about optics and think about why that is."

Transformative Experiences take Shape in Different Ways

Robert Researches Topics Independently

Robert's TEs often extending from class assignments, which prompted him to extend his knowledge toward more independent learning.

"There was one problem I remember in particular, where, uh, there was a car driving and it was some odd distance away, and you want to know the exact moment when the headlights split, but what I was thinking about at that time was what the index of refraction of the actual headlight casing was. It was really bugging me, so I just spent an hour researching the difference between glass and plastic headlights."

Robert has TE in multiple courses and topics.

"Not just on optics and the nature of light but on physics in general, and chemistry for that matter, and mathematics. Any science really. I just love learning about the world."

Madison Shares Science with Family

Madison's TEs took the form of her engaging her family in discussions about things that she found interesting from class.

"With electricity and light bulbs, I know I learned a lot of different things, so I went home and was talking with my husband, and then it would go on to my kids, and we would turn the light bulb or something, or we would talk about the flashlight and different things...The kids also thought it was neat that I was looking at the moon, so whenever the moon was out and I wasn't looking at it they'd holler at me."

Madison's TEs spill over to non-course topics

"I have started thinking and wondering how things work... There is more to every thing in my daily life... What is going on that I don't pay attention to?"

Harrison Sees Optics Everywhere

Harrison's interest in topics covered in class led him to notice examples of optics and the nature of light everywhere.

"I see the light bulb and I think oh, black body, you know, it's getting brighter and the spectrum. When I see glasses I think oh, is that convex or concave, does that mean they are near-sighted or far-sighted? Um, and a camera, I think converging lens. You know light, I think, it's really, I don't know... I can't help but do it. Now that I learned about it, it's everywhere."

Harrison's TE were confined to Optics

"I see [optics] everywhere. This is a topic that I really enjoy...Without a doubt this has been my favorite subject that we've gone over... I like optics. I like light."