Journal of Agricultural Education, 65(4), 317-331
https://doi.org/10.5032/jae.v65i4.2826

Retaining School-Based Agricultural Educators: A System Dynamics Approach

Tiffany A. Marzolino[1]
Aaron J. McKim[2]

Abstract

The teacher retention issue has been plaguing school-based agricultural education (SBAE) since the 1970's. This issue has been investigated from a multiplicity of angles by researchers throughout the discipline. A major gap in the literature, however, comes from the absence of a systems perspective which relates these various empirical studies to one another. This philosophical manuscript proposes a representation of one of the many systems teachers may navigate as they choose whether to remain in or leave the profession. Utilizing literature from the Journal of Agricultural Education, scholarship within the Theory of Margin, experiential knowing, and feedback from current and former teachers, a casual loop diagram (CLD) was constructed to represent one of the systems potentially present in SBAE. This model demonstrates how teachers navigate periods of margin deficit, where their workload is greater than their ability to achieve it. Analysis of the proposed CLD demonstrates there may be an overreliance on the noble sacrifice mindset and an underutilization (or prohibition) of boundary setting driving teachers' decision to leave the profession.

Acknowledgement: We sincerely thank the current and former agriculture teachers who lent their experience and expertise to assisting us with verification of the CLD presented in this manuscript. Those individuals are as follows: Matthew Bernia, Samantha Bos, Josephine Forbush, Katelyn Kelley, and Kera Reterstoff.

Introduction

The continual exodus of teachers from their jobs, 8.0% leaving teaching annually in general education and 6.8% in SBAE (Lawver et al., 2018), has led the profession to be deemed a "leaky bucket" (Sutcher et al., 2016, p. 2). In School-Based Agricultural Education (SBAE), teacher attrition has been identified as a significant challenge (Disberger et al., 2023; Smith & Smalley, 2018; Solomonson et al., 2019; The National FFA Organization, 2022). Research notes personal factors, working conditions, teacher development, and compensation as reasons for agriculture teacher attrition (Solomonson et al., 2018). Stated simply, the solution is to plug the holes in the leaky bucket by retaining teachers (Disberger et al., 2023; Kelsey, 2006; Sutcher et al., 2016); unfortunately, execution of this solution is much more complex. In fact, a growing clamor within the literature suggests systems perspectives are essential to exploring this complex issue (Haddad et al., 2023; Pauley et al., 2019). Within this philosophical manuscript, we employed a system dynamics approach to better understand the teacher attrition phenomena within SBAE.

Purpose

The purpose of this philosophical manuscript is to communicate the conceptualization of a systems model that explores what early career teachers may be experiencing in the profession. The creation of this model was facilitated by employing system dynamics and the Theory of Margin. Understanding this system can help teachers and teacher educators in a variety of ways, including:

[1] Tiffany A. Marzolino is a Graduate Assistant in the Department of Community Sustainability at Michigan State University, 480 Wilson Rd., East Lansing, MI 48824, marzo@msu.edu. https://orcid.org/0000-0003-0478-4626
[2] Aaron J. McKim is an Associate Professor in the Department of Community Sustainability at Michigan State University, 480 Wilson Rd., East Lansing, MI 48824, amckim@msu.edu. https://orcid.org/0000-0002-0600-3611

1. Locating areas in the system where small changes can make big shifts in system behavior, thus allowing individuals to take appropriate action(s).
2. Giving teachers, teacher educators, and any other interested parties vocabulary to associate with different feelings or experiences.
3. A preliminary understanding of one of the many systems teachers may navigate throughout their careers.

An Introduction to System Dynamics

System dynamics was employed to explore this topic. System dynamics is a specific facet of systems thinking and was originally created by Jay Forrester (1968) and further developed by himself and a team at the Massachusetts Institute of Technology. System dynamics has been utilized in a multiplicity of disciplines and contexts since its creation, from management to education. System dynamics also informs the work of Meadows (2008), who defines systems as "an interconnected set of elements that is coherently organized in a way that achieves something" (p. 11), requiring that systems have elements, interconnections, and a function (non-human systems) or purpose (human systems). System structure is thought to drive system function largely via feedback loops, which are interactions between varying factors that magnify a response in one or more variables (Duffy, 2008; Meadows, 2008). See Table 1 for an exploration of these concepts in an SBAE context.

Table 1

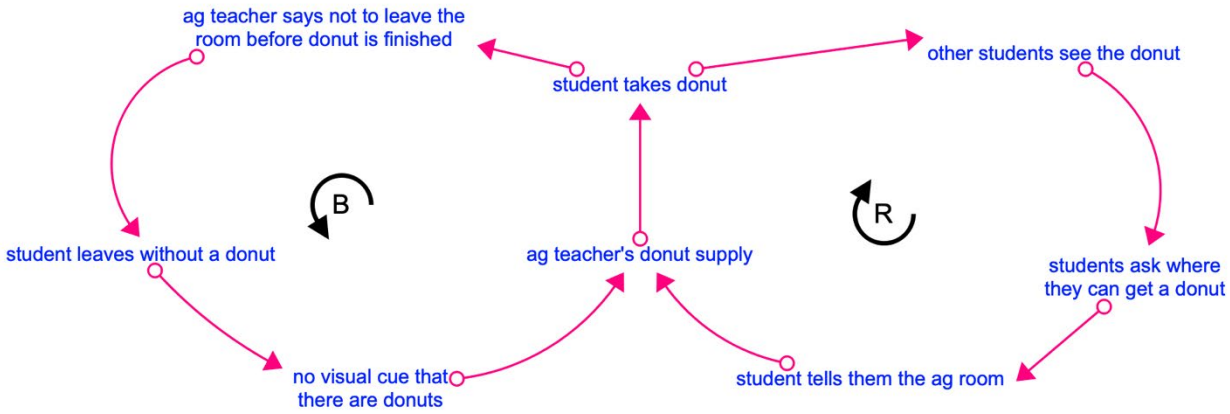
An Exploration of Systems Concepts in an SBAE Context

Item Type	Definition	SBAE Example
System elements	Different aspects within a system.	Teacher, students, and donuts.
Interconnections	Connections between system elements.	Teacher → donut → students.
System function	What a non-human system was designed to do.	The function of a float in a livestock watering tank is to ensure there is always water available; when the float is not atop the water, it will cue inflow to refill the tank.
System purpose	What a human system was designed to do (or is doing unintentionally).	The purpose of the SBAE system is to create agriculturally literate students who are good citizens.
Feedback loop (reinforcing)	When an interconnection creates a circle and comes back to its source, creating feedback; this type of feedback amplifies an effect.	One student leaves the ag room with a donut; other students see the donut and ask where that student got it; a slew of students arrive to the ag room for a donut; as more students see others with donuts, this cycle is amplified because many students would like a donut.
Feedback loop (balancing)	When an interconnection creates a circle and comes back to its source, creating feedback; this type of feedback tries to balance the impact of an effect.	To keep some donuts, the teacher tells the student to eat the donut in the ag room; other students do not see a donut; others do not know the ag teacher has donuts; the ag teacher's supply of donuts remains intact.

System dynamics approaches often involve the usage of models or causal loop diagrams (CLDs) to help visualize a system. In the case of the teacher and their donuts, these loops can be visualized for further clarity.

Figure 1

Example Causal Loop Diagram



Note. The *elements* of the system are represented in blue. The *interconnections* are represented by pink arrows. The R represents the *reinforcing loop* (i.e., cyclical system interaction that amplifies an effect) and the B represents the *balancing loop* (i.e., cyclical system interaction that balances the impact of an effect).

System dynamics approaches are appropriate to use when the problem at hand (i.e., teacher retention) is dynamic, has feedback cycles, and occurs over time (Duffy, 2008; Forrester, 1968; Kim, 2008; Meadows, 2008). Utilizing systems perspectives is recommended in education, especially when looking at the long-term effects of educational policy (Groff, 2013) and can help to make decisions from a variety of levels (i.e., individual, district, regional, state, national). These decisions are generally made at leverage points, defined as "places in the system where a small change could lead to a large shift in [system] behavior" (Meadows, 2008, p. 145). Leverage points outlined by Meadows (2008) include numbers, reinforcing feedback loops, information flows, solving delays, transcending paradigms, and more. See Table 2 for an exploration of these phenomena and examples within SBAE.

Table 2

Leverage Point Types and Examples in SBAE Context

Leverage Point Type	Definition	Example in SBAE
Numbers	The quantities of elements within a system.	Recruits in a teacher preparation program.
Reinforcing feedback loops	Altering the amplification of a reinforcing feedback loop.	A student who has not been turning in any work begins to turn in their work again, disrupting this feedback loop.
Information flows	Preventing or supplying information to other parts of the system.	Telling a parent about a student's poor performance in class.
Solving delays	Decreasing the amount of time a delay takes in a system.	Instead of allowing grading to pile up, grading things the day they are completed.
Transcending paradigms	Pushing people's minds to grow and think in a new way.	Taking disciplinary action against a student's poor choice, which does not repeat because the student learned there were consequences.

Theoretical Background

Our systems model of agriculture teacher attrition was framed using the Theory of Margin (McClusky, 1963). This theory is comprised of three key concepts. First, *load* is all the things an individual is tasked with that require energy, including both internal (e.g., personal goals) and external (e.g., work and family) components (Hiemstra, 1993; McClusky, 1963). Second, *power* is the energy an individual possesses to accomplish their load, which also includes internal (e.g., stamina) and external (e.g., support networks) components (Hiemstra, 1993; McClusky, 1963). Finally, *margin* is the difference between power and load (McClusky, 1963). An individual with margin, where their power exceeds load, has energy available to innovate, learn, and experiment with new ideas; alternatively, an individual without margin, where their load exceeds power, will be bogged down by obligations, precluding them from fully engaging in life (Merriam et al., 2006).

The Theory of Margin was developed to inform adult learning; however, it also has utility in our modeling of agriculture teacher attrition. Individuals are more resilient within, and committed to, systems that afford margin (Biney, 2021). Therefore, modeling the capacity for margin within SBAE is critical to understanding agriculture teacher retention. Furthermore, margin is a prerequisite to teachers bettering the system in which they operate (McKim & McKim, 2023), suggesting margin is critical to continual system adaptation, led by teachers, to be more aligned to their needs, goals, and values.

Methodology

The model developed takes the form of a causal loop diagram (CLD). The CLD was created using Stella Architect Version 3.4 (Stella Architect, 2023). The final diagram was informed by the researcher and a literature review of scholarship published in the *Journal of Agricultural Education* since 2000. Obtaining research for the literature review was facilitated by searching the following keywords: agrarianism, stress, attrition, system, teaching attitude, work-life balance, and job satisfaction. The initial collection of 57

articles was refined to 16 articles based on an analysis of the article titles and review of the abstracts. Salient conclusions within each of the 16 articles were incorporated into the model development process, as highlighted within the presentation of the CLD. Because SBAE teachers are operating within a multiplicity of interconnected systems, all operating on differing temporal and spatial scales, system boundaries must be set before modeling the system. This system is bounded within a school year and is based on an individual's decisions within their career as a teacher. Furthermore, the core of the system is a period of margin deficit; as such, aspects that may be unrelated to influencing this deficit are excluded, as they are not within the system's bounds.

The CLD was evaluated for face and structural validity by various system stakeholders (Burns & Musa, 2001), including two teacher educators, four current SBAE teachers in Michigan, and one former SBAE teacher who recently left the career. Adjustments to the model's structure and the narrative were made accordingly. There are many different symbols utilized to represent concepts within the CLD. These are outlined in Table 3.

Table 3

Symbols Used in Causal Loop Diagrams

Symbol	Meaning
+	Direct relationship between two variables (e.g., as one increases, the other increases).
-	Inverse relationship between two variables (e.g., as one increases, the other decreases).
=	Delay in information between two variables.
→	Relationship between two variables.
R	Reinforcing feedback loop.
B	Balancing feedback loop.

Findings

The model will be presented piece by piece and is color-coded to enhance readability. To enhance clarity, literature will be reviewed as the model is revealed. A narrative will be presented alongside the CLD as well to provide examples of how the concepts in the model may manifest.

This model begins with a teacher experiencing margin deficit, a key assumption of this model. When a teacher is experiencing margin deficit, they need to increase their margin to avoid breakdown. This can be done by increasing power or by decreasing load. In this conceptualization, teachers have a choice; they can choose to rely on the noble sacrifice mindset and take the red route or they can set boundaries and take the green route. Importantly, Traini et al. (2019) found early career teachers could find success or balance, but not both. The authors believe that this success or balance phenomena (Traini et al., 2019) is evidence that the decision in this model exists. See Figure 2.

Figure 2

Core Decision Point

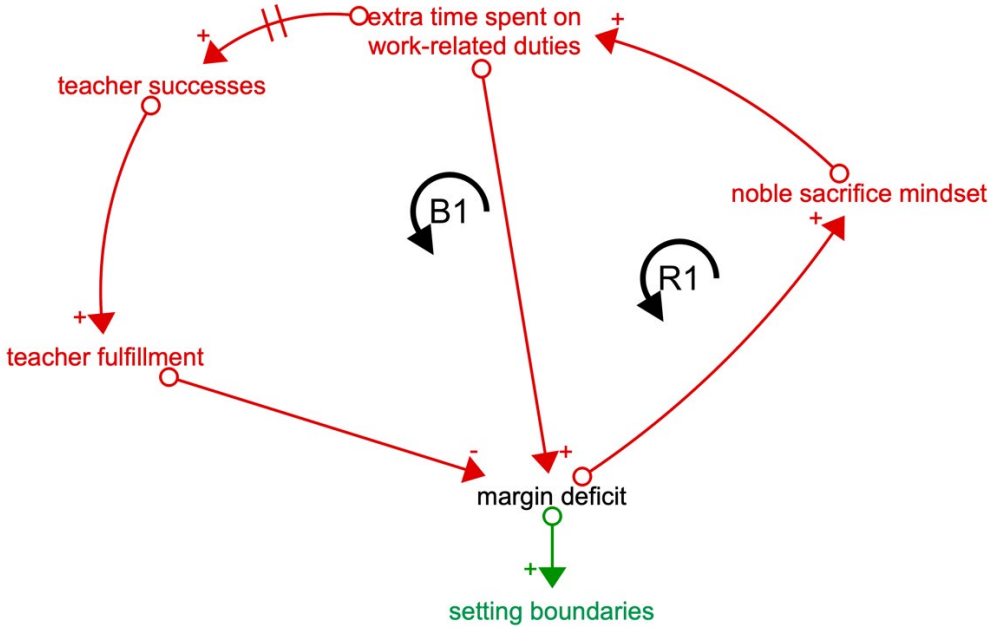
Let's say the teacher chooses to rely on the noble sacrifice mindset. To explore this mindset, one must unpack the phrase itself: *noble*, meaning possessing high moral character, principles, or ideals, and *sacrifice*, meaning an offering, giving something up for something or someone else (Merriam-Webster, n.d.). The noble sacrifice mindset is one in which the teacher is okay with sacrificing their time for something that feels like the right thing to do; as examples, spending more time with students to prepare them for leadership development events, working on the greenhouse roof over the weekend, or spending their evenings devising creative and innovative lesson plans. This mindset can also be invoked by asking teachers to remember their purpose in teaching, their 'why.' The existence of this mindset is thought to be tied to agrarianism and agrarian ideology which may exist in agriculture teachers (Martin et al., 2022; Martin & Enns, 2017; Martin & Kitchel, 2013).

Agrarianism is linked to FFA within SBAE literature. Agrarian views were held by several pre-service teachers enrolled in an SBAE program (Martin & Enns, 2017) and agrarianism can be found in the FFA and its tradition (Martin et al., 2022; Martin & Kitchel, 2013). In their work, Martin and Kitchel (2013) found two themes of agrarianism found in the FFA – dependence on self and loyalty to tradition. The noble sacrifice mindset relies on the teacher pushing themselves to dedicate extra time to seeing students succeed, which may be rooted in tradition. Communities where teachers find themselves may also have traditions teachers are expected to adopt. The teacher themselves may have expectations that stem from traditions valued personally. As such, when confronted with a margin deficit, the teacher operationalizing the noble sacrifice pathway may persuade themselves that they need to be content with this state and the status quo.

Noble sacrifice addresses margin deficit because of its other connections within the system. The entirety of the noble sacrifice route, the red route, is pictured in Figure 3. Our literature review revealed evidence of the noble sacrifice mindset; as an example, Clark et al. (2014) identified teachers extending their work hours by sacrificing family obligations.

Figure 3

Noble Sacrifice Pathway

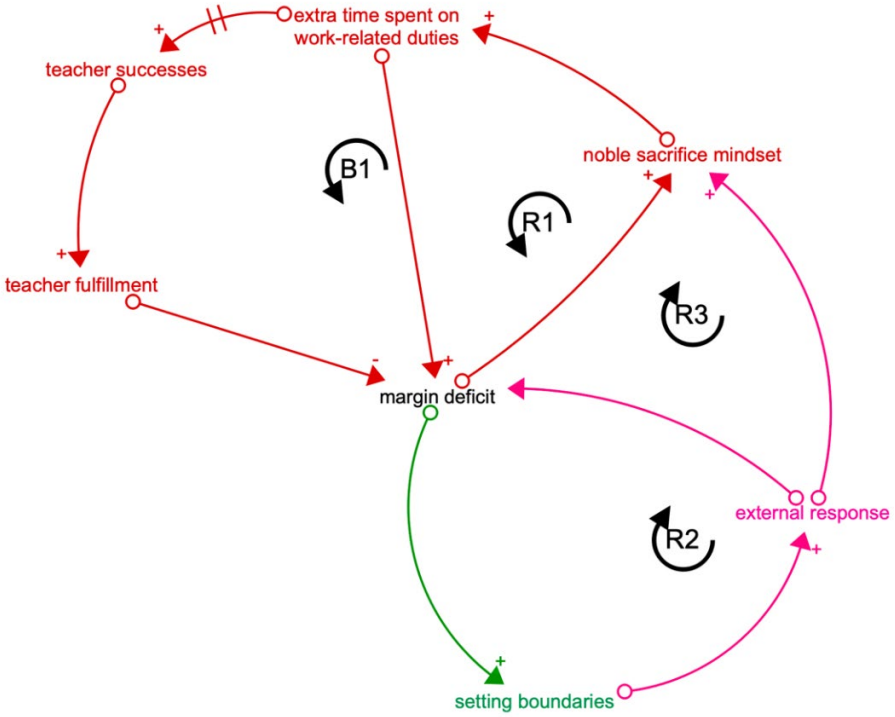


Once the teacher relies on their noble sacrifice mindset, they may choose to increase the amount of time spent with students or on work-related duties. This will increase their load, which creates our first reinforcing loop (R1) by increasing margin deficit. The relief comes once teachers see student success; there is a delay in the system, however, because success is often not an immediate outcome of additional time investment. Success can come in many forms, from teachers finding success in a leadership or career development event, to having a positive interaction with a student that felt highly impactful. As such, teachers may feel their hard work has paid off, which will increase their fulfillment. It is here the first balancing loop (B1) is realized; as teachers rely on the noble sacrifice mindset, they may see student successes increase, which will increase fulfillment and eventually increase teacher power. Once power increases, the margin deficit decreases.

Thus far, the noble sacrifice pathway assumes the teacher is *choosing* to employ the mindset. As noted by Torres et al. (2009), "[a]griculture teachers do have excessive roles and responsibilities, continue to place demands on themselves, and must meet demands placed on them by students, parents, administrators, and peers" (p. 108). This quote is emblematic of teachers choosing to push themselves (and perhaps employing the noble sacrifice mindset to do so) and points a finger to expectations from external others. There is a chance, as outlined in Haddad et al. (2023), that teachers wish to set boundaries but are prevented from doing so by some external response, be it from administrators, community members, alumni, parents, students, etc. Lambert et al. (2012) found teachers were having trouble setting boundaries (i.e., saying no), which may indicate an internal response to external requests. This relationship is captured in Figure 4 in pink, wherein teachers who try to take the green route and set boundaries are forced or expected to take the red route and rely on noble sacrifice instead.

Figure 4

Mandatory Noble Sacrifice



This creates a reinforcing loop between setting boundaries, an external response, the noble sacrifice mindset, and margin deficit (R3). As teachers are pushed to rely on the noble sacrifice mindset, they may build their margin deficit further via the loop labeled R1. The R3 loop demonstrates that a forced reliance on the noble sacrifice mindset via external response may compound the issue, as already stressed teachers experiencing a margin deficit may become more stressed; stress has been found to have a negative correlation with job satisfaction (Ryan et al., 2017).

Furthermore, we posit a potential connection from this external response directly to margin deficit (R2). As teachers try to set boundaries and those boundaries are rejected, their emotional load may rise. It is easy to imagine a scenario in which the teacher wishes to avoid adding another Career Development Event due to being at capacity, but interested students or their families push back. This leads to an undercutting of teacher autonomy and may be accompanied by other negative emotions, causing the teacher to feel less support, which decreases teacher power. This is a reinforcing loop that continues to increase margin deficit. It was suggested by Clark et al. (2014) that teacher autonomy is vital to remaining in the profession, along with support from (school) communities.

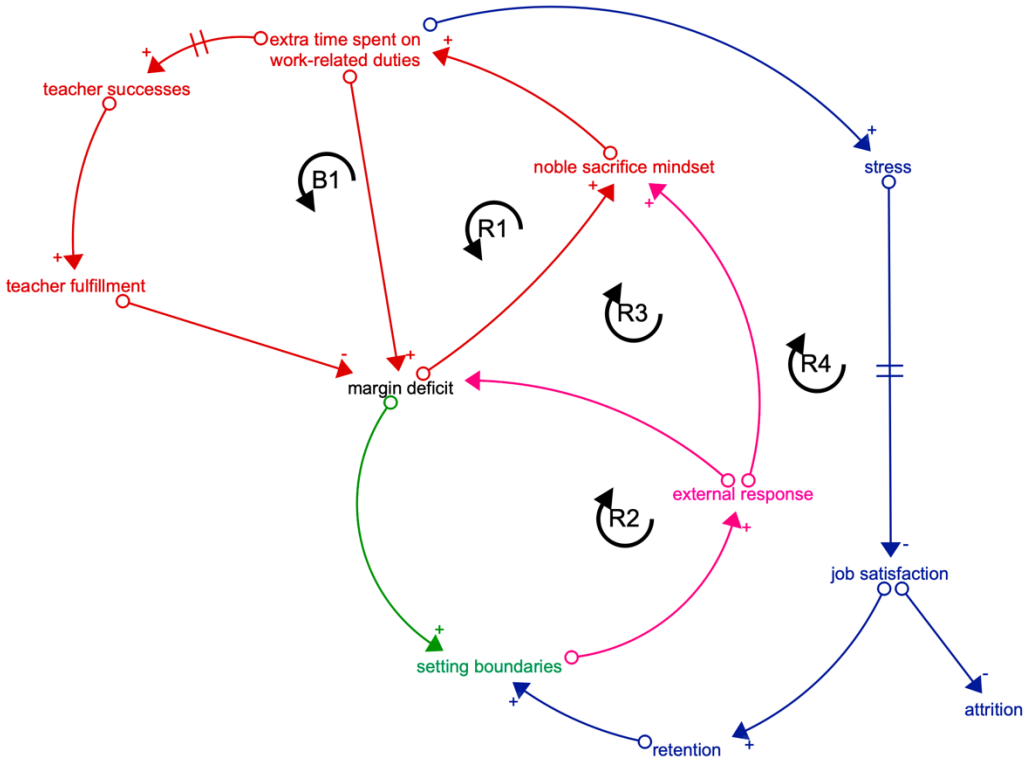
When setting boundaries is not an option allowed by external parties (or the teacher's own expectations of themselves), teachers may be forced to rely on the noble sacrifice mindset to try to power through. If they find enough success to balance their increased load, the noble sacrifice mindset can be a tool. This also circles back into agrarian ideology surrounding many actors in communities or school districts that have an FFA program. Because there is a resistance to "urbanization" (Martin & Kitchel, 2013) and boundary work may be perceived as an "urban" concept, community members may look down on teachers who opt to set firm boundaries. New and early career teachers may be especially vulnerable to these pressures, as the career stage has them searching for relationships and acceptance (Disberger et al.,

2023). Additionally, problems beginning teachers face may vary from those that mid to late career teachers face, as evidenced by research focusing specifically on early career teachers (Myers et al., 2005).

Regardless of the external response, when teachers adopt the noble sacrifice mindset, they will inevitably increase their stress. Classroom instruction, FFA and SAE components of education were revealed as primary drivers of stress in female SBAE teachers (King et al., 2013), ironically the entirety of the three-component model (Croom, 2008). Ritz et al. (2013) reported low to moderate stress levels in West Texas teachers. Kitchel et al. (2012) found teachers were experiencing moderate levels of emotional exhaustion, a symptom of burnout, which is driven by prolonged periods of stress. Kitchel et al. (2012) also posited job satisfaction may be a driver for teachers exiting the profession. Stress has been found to be a predictor of teacher attrition (Ryan et al., 2017). This stress may impact job satisfaction (Kyriacou, 2001), though it may be delayed. This is represented in the blue portion of the model, shown in Figure 4.

Figure 4

Noble Sacrifice and Stress

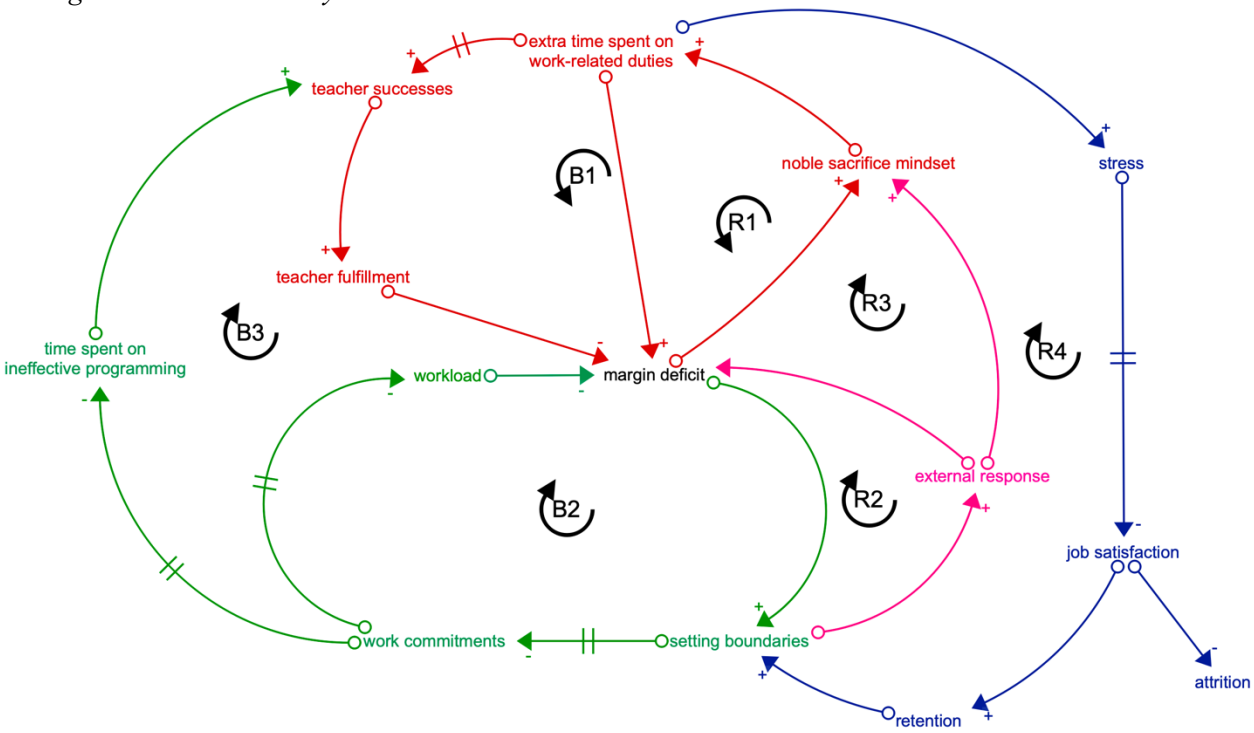


As teachers rely on the noble sacrifice mindset, they inadvertently increase their stress levels, which may lead to job dissatisfaction and questioning whether they ought to persist over time. Should they choose to stay, setting boundaries may be their best option to alleviate margin deficit. This creates another reinforcing loop (R3) where margin deficit can be addressed via boundaries, provided other forces in the system do not prevent teachers from enacting boundaries. Sorensen et al. (2016) hint at a "dangerous spiral of increased work, inability to balance work and family, and job satisfaction," (p. 155) which is represented in this portion of the diagram.

Finally, this brings us to the boundary setting portion of the model, or the green route. This route is pictured in Figure 5.

Figure 5

Setting Boundaries Pathway



After teachers set boundaries, they will spend less time on work outside of school. There is a delay between setting boundaries and reduced work time, however, as there may be some reluctance from the teacher to make this change, or a delay from cutting an annual event from next year's program of activities. Over time, this modification decreases the teachers' load, which will alleviate the margin deficit. This creates another balancing loop (B2) which works via boundaries to decrease workload and keep the margin deficit in check.

The final portion of the green route happens after teachers make cuts to their time spent on work-related activities. Altering the amount of time spent on work commitments could manifest in a variety of ways. Some examples include mastering one contest, designing exciting classroom activities, or simply being more present with students. All these examples can result in success, which can be defined by individual teachers. Seeing student successes increases teacher power via fulfillment, which will reduce margin deficit. This creates another balancing loop (B3) which decreases margin deficit via boundaries (decreasing load) and increasing student success and teacher fulfillment (increasing power).

Conclusions and Recommendations

The system modeled within our CLD resembles a system archetype: shifting the burden, or addiction. This archetype, discussed by Meadows (2008) and Kim (2008), is characterized by relying on something that treats the symptoms of an issue instead of its root. In this system, margin deficit is the root of the issue. Relying on the noble sacrifice mindset is a way to partially alleviate margin deficit, but it is not the "true solution," which is thought to be the freedom to set and maintain boundaries. To escape this systemic trap, Meadows (2008) presents two solutions: not getting into it in the first place or treating the true root of the issue without the employment of the addiction. In this system, the noble sacrifice mindset is the addiction. If we can prevent early career teachers from becoming fully dependent on the noble

sacrifice mindset and, instead, empower them to establish and enact firm boundaries, long-term teacher retention and program success are likely outcomes. Of course, the external response provided by those surrounding the teacher and even the teacher's own definition of success can get in the way. To treat this symptom, we may need to encourage systemic change within SBAE and entreat administrators, community members, parents, and students to be okay with early career teachers (and even those in later career stages) doing what is best for them as opposed to upholding tradition.

As this model is framed around a period of margin deficit, teacher experiences with this system may vary. Nuance exists as teacher power or teacher load are impacted by experience. Teacher power could be bolstered by having established networks, proven classroom management strategies, established curriculum, and more. Teacher load may also fluctuate, with more established teachers able to better manage that load. As such, experience may alter the duration of a margin deficit. As teacher power, load, and margin can fluctuate and are largely dependent upon the individual, this model may not be relevant to all teachers across career stages. Though there may not be generalizability, this model may still be used as a heuristic tool to understand one of the many systems teachers may experience.

There are further limitations to this model. First, this is the mental map of one researcher and supplemented by current teachers and teacher educators; this model was not created by teachers themselves via participatory research methodology, which is generally the recommended route for creating a causal loop diagram. Second, this is a representation of a system that may exist; it is not perfect, nor is it applicable in every situation. We cannot know the true structure of systems, but we can put forth ideas about them and their structure to hone our models. Finally, this system may be influenced by individual or school district factors; there may be some elements that were left out of this model that impact teacher load, power, and margin.

Understanding this system teachers face could be helpful for teacher retention. Additionally, this model could give other stakeholders perspective on how SBAE teachers may be navigating their experiences. If utilized in teacher education, teachers may be aware of these potential pitfalls and be more prepared for what is to come. As such, we have recommendations for teacher educators and SBAE teachers that resulted from this model. First, early career teachers should strive for strong boundary setting, as this may stop them from falling into a prolonged period of margin deficit. Having plentiful margin is important for effective learning and innovation. Second, building a program gradually may be more sustainable. As time is spent in a position, power and load will adjust, allowing for more opportunities to be added which positively impact students. Finally, if teachers find themselves employing the noble sacrifice mindset to cope with workload, defining success in an accessible way to may make this mindset more effective. As an example, if a teacher only defines success as placing first in the state in the Parliamentary Procedure contest, then success can only be achieved by one program; if, instead, success is defined as making meaningful relationships with students, that goal may be more readily achieved and, thus, more favorable for enhancing teacher margin.

The creation of this CLD also resulted in a variety of recommendations for researchers. First, we recommend further validation of this model not limited to a small subset of teachers and teacher educators in one state, affording a broader perspective of this system. Second, investigating other systems teachers may be navigating that impact teacher retention is important. These systems exist at a variety of levels, from the individual to the state, so the more we know, the more dynamics of those systems may reveal themselves so we can access leverage points for systems change. Finally, research exploring the composition of teacher load and power in relation to margin is recommended. The value of this research lies in identifying specific elements of teacher load (e.g., pedagogical innovation, relationship building, curriculum within topics of interest) and power (e.g., volunteer training, innovative professional development, access to financial resources) which uniquely elevate teacher margin, yielding salient recommendations for margin-supporting careers in agricultural education. Furthermore, this scholarship

may also identify specific components of teacher load and power which consistently decrease teacher margin, leading to recommendations to rethink the necessity of these elements within agricultural education.

In closing, anyone interacting with SBAE teachers is shaping this system, knowingly or not. As teacher educators, our approach matters for how future educators will navigate a margin deficit. If we prepare teachers to operate within a system with little reverence for their boundary setting, then they may be more prepared to navigate that system. Alternatively, arming teachers with this model's language and ideation could help them change systems. The more teachers and their supporters resist and modify systems, the more the system will exemplify its adaptive capacity (Meadows, 2008) in a way that affords teacher margin and boundary setting. Either new feedback loops will arise which exacerbate margin deficit or others will arise which increase margin. We may be reaching a point where these systems are going to be altered; thus, we as teachers, teacher educators, and other teacher supporters must be ready to monitor this system at the local, state, and national levels, catalyzing and supporting changes which afford margin. This may require a paradigm shift which, while difficult, is one of the most effective leverage points for making systems change. If we decide, instead, we do not want change, we can stick to the agrarian ideals of tradition and hope we have enough recruits who make it to the proverbial *light at the end of the tunnel* to sustain SBAE and meet demand. Regardless, the choices teacher educators, teachers, and others affecting SBAE systems make will determine how this system does or does not evolve over time.

References

Biney, I. K. (2021). McClusky's Theory of Margin and its implications on adult learners in higher education institutions. *Journal of Adult and Continuing Education*, *28*(1), 98–118. https://doi.org/10.1177/1477971421989337

Burns, J. R., & Musa, P. (2001). Structural validation of causal loop diagrams. In *Atlanta SD Conference*.

Clark, M. S., Kelsey, K. D., & Brown, N. R. (2014). The thornless rose: A phenomenological look at decisions career teachers make to remain in the profession. *Journal of Agricultural Education*, *55*(3), 43–56. https://doi.org/10.5032/jae.2014.03043

Croom, D. B. (2008). Development of the integrated three-component model of agricultural education. *Journal of Agricultural Education*, *49*(1), 110–120. https://doi.org/10.5032/jae.2008.01110

Disberger, B., Washburn, S., Hock, G., & Ulmer, J. (2023). A qualitative analysis of agriculture teacher's attitudinal changes toward the teaching profession in the first three years of teaching. *Journal of Agricultural Education*, *64*(1), 61–81. https://doi.org/10.5032/jae.v64i1.30

Duffy, F. M. (2008). Open systems theory and system dynamics: the twin pillars of transformational change in school districts. In *System thinkers in action: a field guide for effective change leadership in education* (pp. 1–23). Rowman & Littlefield Education.

Forrester, J. (1968). *Principles of Systems*. Pegasus Communications.

Groff, J. S. (2013). Dynamic systems modeling in educational system design & policy. *Journal of New Approaches in Educational Research*, *2*(2), 72–81. https://doi.org/10.7821/naer.2.2.72-81

Haddad, B., Traini, H., & McKim, A. (2023). We've crossed a line: A philosophical examination of systemic implications surrounding SBAE teachers' attempts at boundary setting. *Journal of Agricultural Education*, *64*(1), 82–95. https://doi.org/10.5032/jae.v64i1.31

Hiemstra, R. (1993). Three underdeveloped models for adult learning. In S. B. Merriam (Ed.), *An Update on Adult Learning Theory* (Vol. 57, pp. 37–46). Jossey-Bass Publishers.

Kelsey, K. D. (2006). Teacher attrition among women in secondary agricultural education. *Journal of Agricultural Education*, *47*(3), 117–129. https://doi.org/10.5032/jae.2006.03117

Kim, D. H. (2008). *Systems archetypes I: Diagnosing systemic issues and designing high-leverage interventions*. Pegasus Communications.

King, D., Rucker, K. J., & Duncan, D. (2013). Classroom instruction and FFA/SAE responsibilities creating the most stress for female teachers in the Southeast. *Journal of Agricultural Education*, *54*(4), 195–205. https://doi.org/10.5032/jae.2013.04195

Kitchel, T. J., Smith, A., Henry, A., Robinson, S., Lawver, R., Park, T., & Schell, A. (2012). Teacher job satisfaction and burnout viewed through social comparisons. *Journal of Agricultural Education*, *53*(1), 31–44. https://doi.org/10.5032/jae.2012.01031

Kyriacou, C. (2001). Teacher stress: Directions for future research. *Educational Review*, *53*(1), 27–35. https://doi.org/10.1080/00131910120033628

Lambert, M., Torres, R., & Tummons, J. (2012). The influence of time management practices on job stress level among beginning secondary agriculture teachers. *Journal of Agricultural Education*, *53*(1), 45–56. https://doi.org/10.5032/jae.2012.01045

Lawver, R. G., Foster, D. D., & Smith, A. R. (2018). *Status of the U.S. supply and demand for teachers of Agricultural Education 2014-2016*. http://aaaeonline.org/Teacher-Supply-and-Demand

Martin, M. J., & Enns, K. (2017). The conflicts of agriculture: Exploring the agricultural ideologies of university agricultural education students. *Journal of Agricultural Education*, *58*(1), 207–222. https://doi.org/10.5032/jae.2017.01207

Martin, M. J., Enns, K., & Hartmann, K. (2022). Agrarianism in agricultural education: A narrative study. *Journal of Agricultural Education*, *63*(3), 135–148. https://doi.org/10.5032/jae.2022.03135

Martin, M., & Kitchel, T. (2013). Agrarianism: An ideology of the National FFA organization. *Journal of Agricultural Education*, *54*(3), 28–40. https://doi.org/10.5032/jae.2013.03028

McClusky, H. Y. (1963). The course of the adult life span. In W. C. Hallenback (Ed.), *Psychology of Adults* (pp. 10–20). Adult Education Association of the U.S.A.

McKim, A. J., & McKim, L. K. (2023). Enhancing professional development by increasing agricultural educator margin. *Journal of Agricultural Education*, *64*(3), 16–25. https://doi.org/10.5032/jae.v64i3.48

Meadows, D. H. (2008). *Thinking in systems: A primer*. Chelsea Green, White River Junction.

Merriam, S. B., Caffarella, R. S., & Baumgartner, L. M. (2006). *Learning in adulthood: A comprehensive guide*. John Wiley & Sons, Incorporated. http://ebookcentral.proquest.com/lib/michstate-ebooks/detail.action?docID=792611

Merriam-Webster. (n.d.). *Noble*. Merriam-Webster.com. Retrieved January 15, 2024, from https://www.merriam-webster.com/dictionary/noble

Merriam-Webster. (n.d.). *Sacrifice*. Merriam-Webster.com. Retrieved January 15, 2024, from https://www.merriam-webster.com/dictionary/sacrifice

Myers, B. E., Dyer, J. E., & Washburn, S. G. (2005). Problems facing beginning agriculture teachers. *Journal of Agricultural Education*, *46*(3), 47–55. https://doi.org/10.5032/jae.2005.03047

Pauley, C., McKim, A., & Hodbod, J. (2019). A social-ecological resilience perspective for the social sciences of agriculture, food, and natural resources. *Journal of Agricultural Education*, *60*(4). https://doi.org/10.5032/jae.2019.04132

Ritz, R., Burris, S., & Brashears, T. (2013). The effects of a time management professional development seminar on stress and job satisfaction of beginning agriscience teachers in west Texas. *Journal of Agricultural Education*, *54*(3), 1–14. https://doi.org/10.5032/jae.2013.03001

Ryan, S. V., von der Embse, N. P., Pendergast, L. L., Saeki, E., Segool, N., & Schwing, S. (2017). Leaving the teaching profession: The role of teacher stress and educational accountability policies on turnover intent. *Teaching and Teacher Education*, *66*, 1–11. https://doi.org/10.1016/j.tate.2017.03.016

Smith, A. R., & Smalley, S. (2018). Job stress, burnout, and professional development needs of mid-career agricultural education teachers. *Journal of Agricultural Education*, *59*(2), 305–320. https://doi.org/10.5032/jae.2018.02305

Solomonson, J. K., Korte, D. S., Thieman, E. B., Rettalick, M. S., & Keating, K. H. (2018). Factors contributing to Illinois school-based agriculture teachers' final decision to leave the classroom. *Journal of Agricultural Education*, *59*(2), 321–342. https://doi.org/10.5032/jae.2018.02321

Solomonson, J. K., Thieman, E. B., Korte, D. S., & Retallick, M. S. (2019). Why do they leave and where do they go? A qualitative study of Illinois school-based agriculture teachers who left the profession. *Journal of Agricultural Education*, *60*(4), 115–131. https://doi.org/10.5032/jae.2019.04115

Sorensen, T. J., McKim, A. J., & Velez, J. (2016). A national study of work-family balance and job satisfaction among agriculture teachers. *Journal of Agricultural Education*, *57*(4), 146–159. https://doi.org/10.5032/jae.2016.04146

Stella Architect Version 3.4 [Computer software]. (2023). Retrieved from http://iseesystems.com

Sutcher, L., Darling-Hammond, L., & Carver-Thomas, D. (2016). *A coming crisis in teaching? Teacher supply, demand, and shortages in the U.S.* Learning Policy Institute. https://doi.org/10.54300/247.242

The National FFA Organization. (2022). *FFA Statistics*. https://www.ffa.org/statistics/

Torres, R., Lawver, R., & Lambert, M. (2009). Job-related stress among secondary agricultural education teachers: A comparison study. *Journal of Agricultural Education*, *50*(3), 100–111. https://doi.org/10.5032/jae.2009.03100

Traini, H., Claflin, K., Stewart, J., & Velez, J. (2019). Success, balance, but never both: Exploring reified forms of success in school-based agricultural education. Journal of Agricultural Education, 60(4), 240–254. https://doi.org/10.5032/jae.2019.04240