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System dynamics modeling to understand mental model of public humiliation in medical education

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ABSTRACT

Background: Mistreatment in medical school is a wicked or complex problem demonstrating inter-relatedness and dynamicity of factors that affect students. Many studies have outlined the causes, perceptions, and negative consequences of mistreatment; however, a comprehensive mental model of public humiliation, the most common type of mistreatment, is still incomplete. This study aims to provide insight into the reasons why public humiliation in medical school continues to be a problem despite existing for decades, and to propose a shift in paradigm that potentially improve these incidents.

Method: A systems thinking approach is used to conceptualize related components of public humiliation and student behavior. System dynamics modeling was conducted through narrative review, developing a causal loop diagram (CLD), and validation of results with 60 medical students and 40 medical educators.

Results: Findings from the narrative review outlined key variables, interconnections and five emerging themes: etiology, eustress, motivation, distress, and self-esteem. The themes were conceptualized and constructed into feedback loops as a basis for the CLD. Finally, the mental model proposes three major systems underlying the consequences. The "No Pain, No Gain" illustrates the perception that stress positively drives learning, while "Stress Overload" displays the negative consequences of public humiliation. Lastly, "The Delayed Side Effect" refers to long-term side-effects on self-esteem.

Conclusion: The mental model illustrates how public humiliation has both immediate and delayed side-effects, simultaneously succeeding and failing at motivating student growth. Therefore, public humiliation requires continuous changes in perspective along with multiple interventions to overcome the vicious cycle.

KEYWORDS

Theory; teaching and learning; medicine; profession; education environment; curriculum; student support; management

Introduction

Mistreatment has been commonly known to existing in medical school. The incident is defined by the Association of American Medical College as disrespect for the dignity of others, including behaviors of sexual harassment, discrimination, public humiliation, psychological punishment, and more (Association of American Medical Colleges 2020). While there are many forms of mistreatment, public humiliation is not yet well conceptualized in the medical curriculum. Public humiliation is defined as a "created experience of embarrassment with negative intent on the part of the perpetrator" (Markman et al. 2019). A survey done in 2016 reported 21.2% of students have experienced public humiliation at least once in medical school. Unfortunately, 4 years later in 2020, the number increased to 21.8%, illustrating the need to address this issue (Association of American Medical Colleges 2020). Despite decades of well-systematized scientific evidence about the negative consequences (Fnais et al. 2014), public humiliation and its impact still exist and are difficult to be eradicated (Halim and Riding 2018).

Public humiliation most often originates from a misunderstanding among many educators that it is an effective pressure on students to motivate studying (Association of American Medical Colleges 2020). However, the act itself has both short-term and long-term implications on students that might be hidden or unseen by educators. For example, it generates stress among students and may lead to burnout, demotivation, and reducing confidence in clinical skills (Heru et al. 2009; Shdaifat et al. 2020). With students continuing to be unreasonably pressured, long-term consequences introduce lower student quality of life, academic performance, and overall satisfaction of curriculum, which faculty members should be concerned of.

Practice points

- Public humiliation is a wicked problem which simple and linear solutions cannot solve easily.
- A snapshot of benefit perpetuates the cycle of public humiliation.
- Stress should be optimized because it can either increase or decrease drive to learn.
- Long-term side-effects of public humiliation on self-esteem are inadequately monitored.
- Public humiliation exists because of applying "fix that fail" by teachers.

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Both short-term and long-term effects of public humiliation disclose a larger picture or mental model that consists of assumptions and beliefs behind the phenomenon. Kassebaum describes mistreatment as a "transgenerational legacy" where the act of abuse repeats in a perpetual cycle throughout the levels of training (Kassebaum and Cutler 1998). As the vicious cycle continues, it generates a culture among physicians that intrinsically believes that "tough love" maximizes productivity in students. This complexity makes apparent that public humiliation is not merely the sum of events but is rather a system with consequences and reinforcements. Thus, alleviating this issue not only solves mistreatment in the present, but also terminates future hierarchical structures in medical schools.

To thoroughly understand the depth and complexity of public humiliation, this study aims to explore and visualize the phenomenon through tools that will further help investigate leverage points. In 1973, Rittel and Webber firstly defined wicked problems or complex problems as problems that cannot be solved easily by conventional scientific and linear approaches (Rittel and Webber 1973). Public humiliation in medical school is potentially included in this type of problem. By applying the systems thinking approach (Kreuter et al. 2004), we aim to explore the systems structure and mental model that causes the behaviors or problems instead of reacting to public humiliation at only the superficial level (Ecochallenge 2022). In this work, we established two research questions to guide the review:

i. What is the mental model of public humiliation in medical school?
ii. Why does public humiliation still exist as a vicious cycle in the 21st century?

Materials and methods

As public humiliation is a complex social phenomenon which requires a broad perspective to conceptualize, a system dynamics method was applied. Our key steps comprise of narrative review, development of causal loop diagram (CLD) and validation of results (Olivier et al. 2017).

Narrative review of literature

A narrative review is useful in melding together many components of information to comprehend this occurrence. Many aspects of a narrative review give an advantage that a narrow focus of a systematic review cannot provide, including an inclusive coverage of a wide range of issues (Green et al. 2006). A preliminary literature review was performed by searching in Google Scholar database to capture a transdisciplinary view. The key terms broadly comprise the definition of public humiliation, and its cause and effects. Only literature in health profession education and learning context were included. Then, two researchers separately reviewed and cooperatively made decisions on the final list of papers based on the title and abstract, where the main

Table 1. Findings from narrative review and preliminary extraction of key variables, interconnections, and main themes.

Paper no.	Author (Year)	Causes and effects of public humiliation and associated aspects	Model variables and connections	Theme
1	Kost and Chen (2015)	Medical educators employ "pimping" with a misunderstanding of a Socratic teaching method. "Pimping" evokes negative emotions and is not conducive to adult learning.	Poor student performance → increase verbal abuse → increase stress	Etiology
2	Belsey (2014)	Student inadequacies are the primary activator for intense questioning.	Poor student performance → increase verbal abuse	
3	Seabrook (2004)	Doctors rationalize intimidation with that it helps students learn by exposing their deficiencies and motivating them. It also prepares students for their working lives.	High level of verbal abuse → increase stress → increase drive to learn	Eustress
4	Boghossain (2012)	Teachers understand that Socratic pedagogy induces humiliation and shame in students which results in greater understanding of content.	High level of verbal abuse → Stress → increase drive to learn	
5	Kaiseler et al. (2009)	Stress has been linked to enhanced motivation, support-seeking behavior and working harder.	High level of stress → increase drive to learn	
6	Webb et al. (1997)	Higher motivation correlates with higher grades.	High drive to learn → increase self-studying time	Motivation
7	Adib et al. (2019)	There is a positive and significant relationship between self-directed learning and academic motivation.	High drive to learn → increase self-studying time	
8	Rudland et al. (2020)	Stress can be interpreted as hindering, hence may result in negative effects.	High level of stress → decrease drive to learn	Distress
9	Dyrbye et al. (2005)	Distress in medical school can lead to cynicism, students' care of patients, relationship with faculty and ultimately the culture of the medical profession.	Stress → decrease drive to learn	
10	Shors (2004)	Acute stress can impede learning and impair performance on spatial learning tasks.	High level of stress → decrease drive to learn	
11	Schuchert (1998)	Positive correlation between verbal abuse and lower levels of confidence in students with high and low abilities and high and low levels of assuredness.	Being verbally abused → decrease self esteem	Self Esteem
12	Jirdehi et al. (2018)	There is a significant relationship between grade point average and educational self-esteem, raising the importance of self-esteem in academic achievement.	High self-esteem → improve students' performance	
13	Arshad et al. (2015)	It was found that there was a significant positive relationship ($r = 0.879$, $p < 0.01$) between self-esteem and academic performance.	High self-esteem → improve students' performance	
14	Zimmerman (1995)	Self-efficacy influences students' learning through cognitive as well as motivational mechanisms.	High self-esteem → increase drive to learn	
15	Zeigler-Hill et al. (2013)	Unstable self-esteem was associated with poor academic performance in American undergraduates. Low self-esteem was associated with higher levels of academic disengagement and devaluation for individuals with high levels of self-esteem.	Low self-esteem → decrease drive to learn	

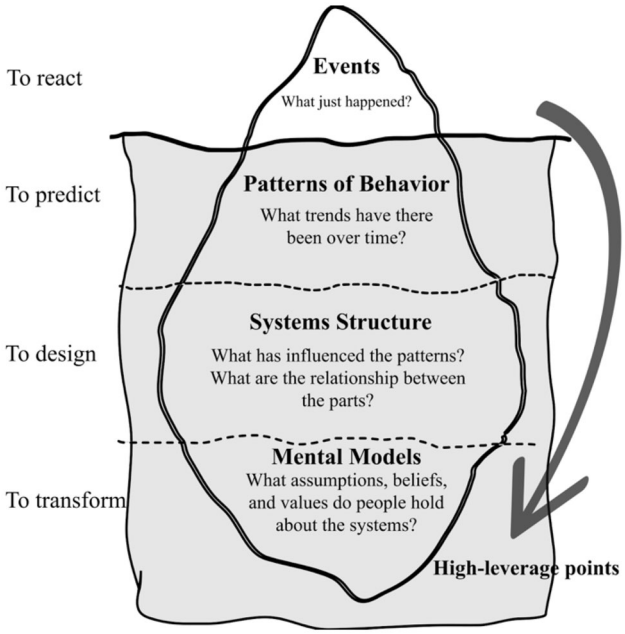

Figure 1. Illustrates the iceberg model of systems thinking which was adapted from Ecochallenge with permission.

points potentially answered the research question. After the selection was done, all researchers went through all selected literature and qualitatively analyzed the data into emerging themes and held regular meetings to identify variables followed by refining the themes.

Developing of CLD

In parallel with qualitative analysis of the data, a table of variables was developed to capture causal linkage between variables for exploring the mental model (Table 1). A CLD, a systems dynamics tool (Bala et al. 2017; Dhirasasna and Sahin 2019), was used to explore the problem in deeper levels of systems which consist of variables and their relationships. The CLD consists of critical components and their interconnection constructed on Stella Architect ver. 1.9.4 (ISEE Systems Inc). Arrows and polarities (+ or −) indicate the direction and mechanism. For example, A −>+ B denotes that A causes a change on B in the same direction. On the other hand, A−>− B represents the change in the opposite direction. A feedback loop is created from variable to variable, which can be traced back to its originating variable. The loop can be categorized into two types: a balancing loop (designated by B) that generates stability over time and a reinforcing loop (designated by R) that compounds either growth or decay over time.

Validation of results

The discussion for validation on the result was performed between different stakeholders in the school: systems methodology experts, medical school administrators, medical educators, and medical students. The systems expert firstly refined the result in technical aspects, followed by validating the mechanism and archetype of CLD. The validating session included focus group discussion and in-depth interview with sixty medical students and forty medical educators. The final version of CLD was

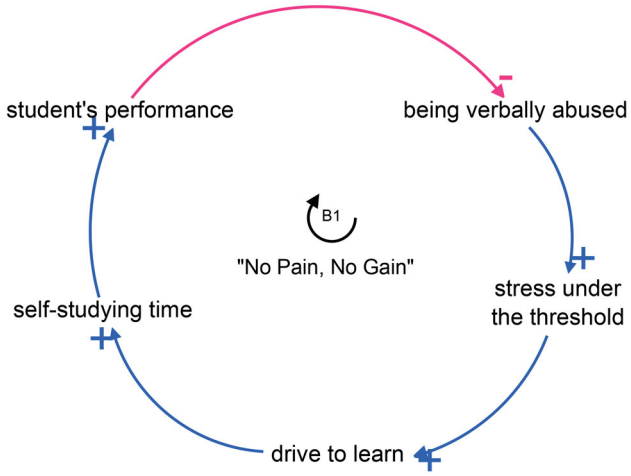

Figure 2. Illustrates a balancing loop (B1) named "No Pain, No Gain." The negative arrow indicates inverse relationship while the positive arrows show positive correlation.

conceptualized in three loops as a mental model of public humiliation presented in the "Results" section (Figure 1).

Results

Narrative review

Extensive literature review was scoped in causes and effects of public humiliation which were grouped into five themes: etiology, eustress, motivation, distress, and self-esteem. Table 1 demonstrates the model variables and their connections as initial substance for developing CLD.

CLD

Based on findings from the narrative review, the synthesized CLD consists of three feedback loops underlying the wicked problem of public humiliation. The whole mental model comprises a balancing loop (B1: No Pain, No Gain), the first reinforcing loop (R1: Stress Overload), and the second reinforcing loop (R2: The Delayed Side Effect).

The first part of mental model: "No Pain, No Gain" etiology

In "No Pain, No Gain," as students' performance reduces below teacher's perceived acceptable level, they are verbally abused by teachers, causing an immediate reaction that induces stress in students. With an incentive to perform better, students study more, resulting in higher performance in class that reduces abuse and humiliation from teachers. Consequently, due to the nature of the balancing loop, students' performance will fluctuate based on whether they experience verbal abuse (Figure 2).

The second part of mental model: Stress paradox in learning

"Stress Overload" describes the effect of verbal abuse in the form of public humiliation on unhealthy stress that negatively affects students. While stress can be an incentive for students to study more, as described in B1, accumulated stress over an individual's threshold can damage a student's drive to learn. As students become demotivated, they study less, leading to a decrease in performance in

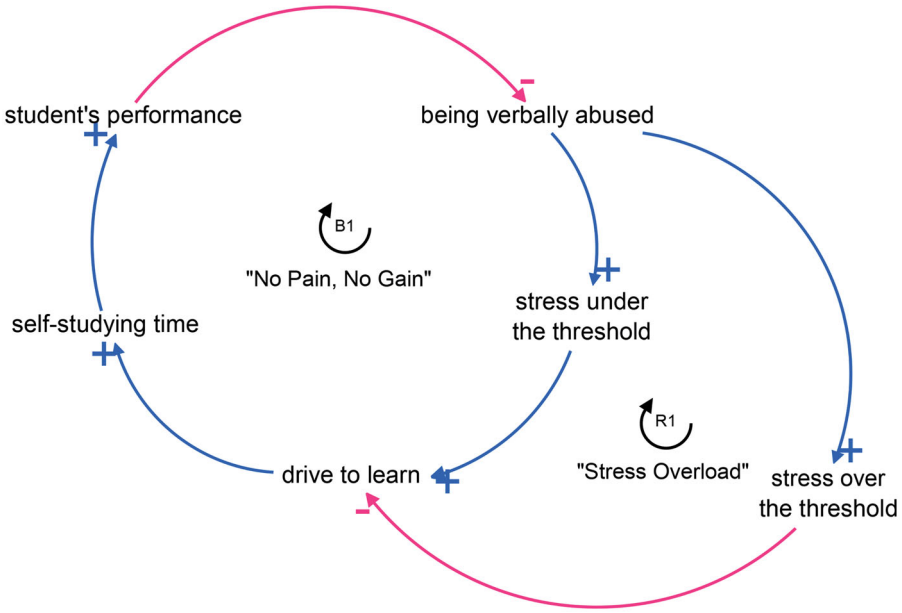

Figure 3. Shows the interconnection from two types of stress, illustrated in a balancing loop (B1) named "No Pain, No Gain" and a reinforcing loop (R1) "Stress Overload.".

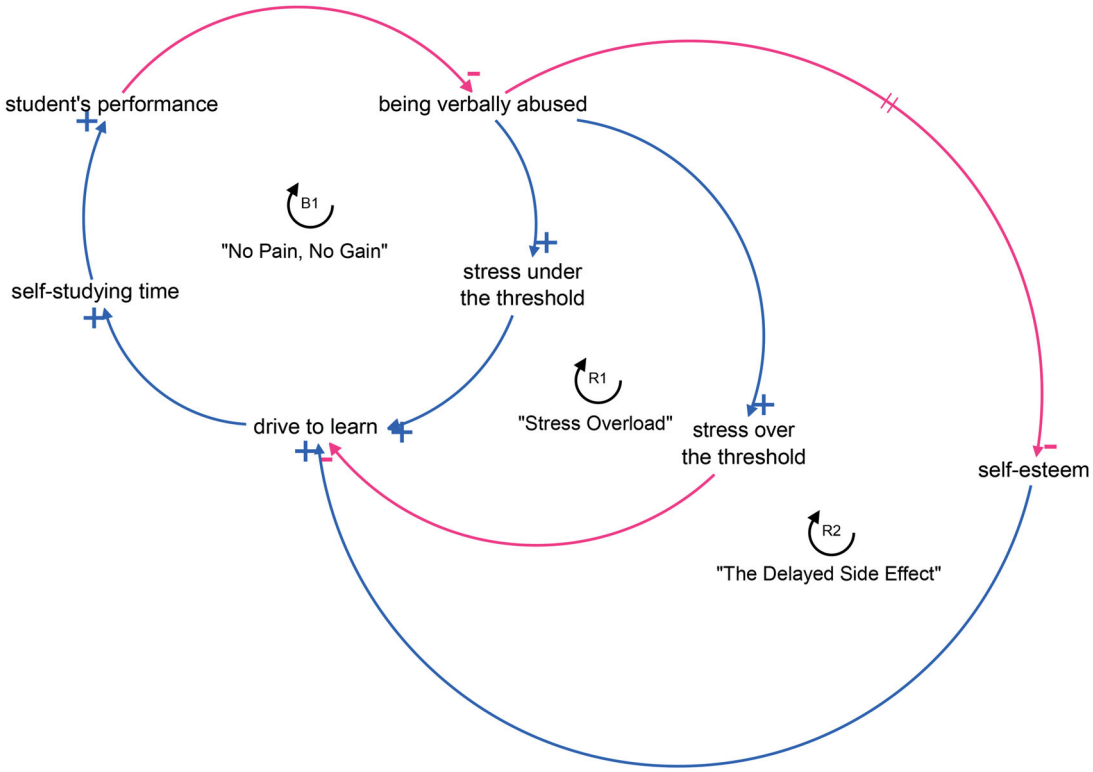

Figure 4. Illustrates one balancing loop (B1) named "No Pain, No Gain" and two reinforcing loops (R1) "Stress Overload" and (R2) "The Delayed Side Effect.".

class and ultimately inducing abuse from teachers. This series of actions is a vicious cycle in which continuously reduces students' performance over time. Conversely, less abuse will cause less distress leading to higher motivation and performance (Figure 3).

The third part of mental model: Delayed side-effect on self-esteem

Due to "The Delayed Side Effect," public humiliation causes a long-term effect on students' self-esteem. Lower self-esteem decreases the drive to learn in the long term, leading to poorer performance that provokes abuse from teachers. The negative reinforcement loop can be both destructive and constructive depending on the amount of public humiliation and its effects on self-esteem and stress (Figure 4).

Conclusion

The mental model seen in Figure 4 explains how public humiliation has both immediate and delayed side-effects, simultaneously succeeding and failing at motivating student growth. Mapping the interrelation of these elements helps us realize that the wicked problem is deeply rooted in the values and beliefs of educators, and that this complex problem requires more than just a onetime event to solve the issue.

Discussion: "fix that fail"

The CLD allows us to understand that many teachers continue to embarrass their students as they only see the short snapshot of benefits that immediately follow public humiliation and fail to see the long-term effects on student's psychological well-being. As a result, seeing instant responses verifies their reasoning and perpetuates the cycle of abuse in medical school.

This is consistent with a "fix that fail" archetype (Kim 1995), an archetype in systems science that describes a "fix" intervention for the problem that is effective for only a short term but creates delayed "failed" consequences on stress and self-esteem. The B1 and R1 illustrate the immediate effects of humiliation, while the R2 has a delayed effect over time, where teachers see only a snapshot of benefits without being aware of the side-effects on student's self-esteem.

Therefore, fixing public humiliation in medical school is not merely a reaction to a series of events, but requires a change in perspective over time. The interconnection of elements in the CLD shows that once verbal abuse has been redirected, it can synergize aspects of students' persona that not only positively impact student performance, but quality of life and satisfaction in the medical curriculum as a whole.

Recommendation

Further investigations

The CLD, like all models, is a partial and incomplete reflection of reality. Despite the benefit of visualizing the mental model, quantitative systems dynamic modeling such as Behavior Over the Time and stock and flow diagram are recommended for further predictive models. Moreover, the diagram may have potential biases due to addition of some inferred linkages not directly identified in the literature. Although narrative review provides the breadth and depth of searching, systematic review should be applied to provide more inclusive perspectives.

As the validation of results was done from Thai participants, this mental model may be more applicable to Asian countries with similar cultures. The further mental model requires perspectives across different cultures along with contexualization before applying the result. Widening systems boundary with other psychosocial, environmental, and cultural aspects affecting mistreatment and public humiliation is recommended to expand upon this initial mental model.

Possible high-leverage interventions

As public humiliation is a complex problem, it is difficult to understand the issue with a long-term perspective instead of a snapshot view. The complexity, consequently, makes it nearly impossible to correct by simple solutions that only prohibit acts of public humiliation itself. Therefore, medical educators should treat this problem with complexity awareness as a golden rule for further intervention.

Multiple interventions should be applied to shift from the snapshot of "No Pain, No Gain" into a virtuous and sustainable cycle in grooming healthy students. The ideal student is a motivated and competent learner who keeps improving themselves without the need of aggressive verbal stimulation from their teacher. So, we proposed highly connected variables as candidates for possible leverage points: stress, being verbally abused, and self-esteem.

Firstly, to address the misconceptions from a snapshot view, continuity of close supervision is recommended to educators. Stress can either reinforce or reduce students' motivation and has side-effects teachers should be aware of. As many educators address learning as merely events, continuity of close supervision can show long-term stress consequences of unhealthy teaching methods, offering insight beyond the snapshots of events.

Secondly, to avoid verbal abuse, educators should apply higher questioning methods in their teaching. Medical educators should always realize the purpose of each question and adjust it based on the scope of necessity. Advancing questioning from testing knowledge and comprehension to applying and analyzing knowledge as in Blooms' taxonomy can add value to the learning experience (Taylor and Hamdy 2013). Questioning should be redesigned from knowledge-centered to learner-centered, which means questioning has not been used for knowledge inquiry but used for assisting the learners in modulating their learning as adults (Kost and Chen 2015).

Lastly, to boost and sustain student self-esteem, applying adult learning theory is recommended. Teachers should perceive that the students could learn by themselves. The role of teachers is to encourage intrinsic motivation and autonomous self-regulation for learning, as known that these are positively correlated with academic performance and well-being (Ten Cate et al. 2011). Furthermore, teachers should provide abundant resources and a safe psychological space where students can openly ask for academic help without abusive responses from their teacher. As the learning experience should be humanized, psychological well-being is fundamental to develop self-esteem, but public humiliation is an obstacle to students' learning.

For this reason, after identifying possible high-leverage points with complexity awareness, multi-intervention can shift the paradigm from the fear model in hierarchical learning to a motivational environment. These modern approaches can not only end mistreatment but also succeed in grooming competent students continually.

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