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Modeling and Simulating Student Protests Through Agent-Based Framework

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ABSTRACT

This paper presents an agent-based model to study the effect of grievance, net risk, social, sympathy, and political influence on the likelihood of student protests emerging in South Africa universities. Studies of student protests in several fields have been conducted, but no ABM has been used to explore factors contributing to student protests. Student protests have proved to be disorderly, frequently leading to property damage, academic program cancellations, and injuries. Simulation experiments demonstrated that inequality level, number of activists, activist's influential size, number of friendship ties, suspend delay, and sympathy are elements that determine the model of social conflicts, since there are statistically significant in the logistic regression. For university administration to effectively handle disruptive student protest actions, risk management policies should focus on understanding network structures that integrate students' interactions to monitor the spread of opinions that initiate protest mobilization.

KEYWORDS

Agent-Based Model, Network Influence, Political Influence, Relative Deprivation, Social Conflicts, Social Influence, Student Protest, Sympathy

INTRODUCTION

Student protests at Public Higher Education Institutions (PHEI) in South Africa continue to be prevalent, even after more than two decades of democracy, for example, #FeesMustFall protest (Luescher, Loader, & Mugume, 2017). Students are becoming impatient when faced with current high tuition fees, decreased funding opportunities, inadequate student residence, and significant academic and financial exclusions, given the current political and socio-economical landscapes fueled by the promise presented by the National Plan for Higher Education (2001) document (Dominguez-Whitehead, 2011), hence we are currently witnessing high volume of state-directed protests in our

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institutions. Recent student protest actions have proven to be unruly and frequently leading to property damage, academic program cancellations, intimidation of non-protesting students, and injuries (Peté, 2015). Several studies of student protest have been conducted in a variety of fields, including social and political studies (Oxlund (2010); Dominguez-Whitehead (2011)), but no agent-based model (ABM) has been suggested to predict student protests at higher education institutions. The construction of such a model will aid in the forecasting of student protests.

Studying how social conflicts emerges from social context and how they lead into a protest remains a central important topic in political studies, history, social psychology, and sociology (Lemos, Lopes, & Coelho, 2014a). However, several studies that seek to evaluate communities through the framework of complex adaptive systems have increased in the last decade. The most adopted approach in modelling complex system is bottom-up technique, which represent a fundamental characteristic of ABM (Ormazábal, Borotto, & Astudillo, 2017). A number of studies based on conflict or violent collective behavior have shown how ABM through crowd simulation can support the development of a useful techniques to examine protests (Bhat & Maciejewski, 2006; Epstein, 2002; Lacko et al., 2013). In the early-2002, Epstein developed a widely adopted classical agent-based computational model of civil violence, and since then, crowd simulation has evolved. For example, the Epstein's model was adopted by among other, Lemos, Lopes, and Coelho (2014b), Kim and Hanneman (2011). Agent-Based Modeling Simulation (ABMS) approach is ideal when modeling a complex scenario, for example, studying the behavior of actual protest participants which involves the interaction of heterogeneous agents (Pires, 2014). This study aims to design, implement, and simulate a theoretically grounded Agent-Based Model (ABM) that predicts the emergence of student protests in order to gain insight understanding of macro-level behavioral dynamics of a complex student protest system at Public Higher Education Institutions (PHEI) in South Africa. The proposed model will assist in identifying micro-level behavioral patterns which may result into a protest action. The understanding of this emergent behavior will assist university management in several ways, such as identifying behavioral patterns that may result into a protest and subsequently prevent damage to property, intimidation of staff and non-protesting students and possible injuries (Peté, 2015).

The structure of this article is as follows: In the second section, an overview of the agent-based modeling method is provided. Then, the article presents an investigation of ABMs of social conflicts proposed by other scholars. Hypotheses and a conceptual model are then introduced with the description and implementation of the model. The article is concluded by the findings of the simulation experiment and followed by conclusion.

AGENT-BASED MODEL

ABM is an early majority modelling paradigm that is gaining its popularity in several fields that leads to modelling of complex dynamic systems such as student protests, artificial financial markets, pedestrian movement, and population dynamics (Macal & North, 2008). Agent based model is normally used as a bottom up individual-based approach to simulate heterogeneous and autonomous decision-making agents that uses behavioral rules to interact with their artificial world (Kiesling, Günther, Stummer, & Wakolbinger, 2012). ABM can be utilized as a methodology to simulate behavioral patterns which are challenging to be modelled using mathematical equations (Dada & Mendes, 2011). In addition, interactions of the agents within an ABM are represented by a set of behavioral rules and the emerged behavioral actions or patterns are observed at the macro level. Agents social interactions may have non-linear influence which can be a challenge to represent using analytical mathematical equations (Lu, 2017).

In ABM, social interactions can be categorized as micro-level, meso-level and macro-level. Micro-level represent agent to agent or agent to environment interactions at a local level (Démare, Bertelle, Dutot, & Lévêque, 2017). At micro-level, students can exchange their discrepancies in resources allocation (levels of inequalities) to formulate their dissatisfaction or grievances. Meso-