Executive Summary

Purpose:

As part of the Simulation Modeling for an Immersive Learning Experience (SMILE) project, the Voting Equipment Breakdowns module investigates the effect of one or more pieces of voting equipment breaking down on Election Day. Through computer simulation, voter wait times are estimated for two polling locations that experience voting equipment breakdowns. Here, we explore the effect of different types of equipment breaking down and the impact of several resolution strategies.

Voting Processes:

1. Polling Location A: consists of a check-in step using electronic poll books (i.e., 3 devices), ballot marking using pen and paper at a voting booth (i.e., 10 booths) or an accessible ballot marking device (i.e., 1 device), and ballot scanning at an electronic ballot scanner (i.e., 1 device). When fully operational, this polling location experiences a 12-minute average voter wait time when 1,500 voters arrive throughout Election Day.
2. Polling Location B: consists of a check-in step using electronic poll books (i.e., 3 devices), a ballot marking step using a digital ballot marking device (i.e., 12 devices) or an accessible ballot marking device (i.e., 1 device), and ballot submission step at an electronic ballot scanner (i.e., 1 device). When fully operational, this polling location experiences a 26-minute average voter wait time when 1,500 arrive turnout throughout Election Day.

Voting Equipment Breakdown Scenarios:

1. Check-in Device Breakdown: investigates one or more electronic poll books breaking down on Election Day at 8:15 am, the busiest time at each polling location. In response to a breakdown, election workers may choose not to repair the broken-down device(s), attempt to have the broken-down equipment repaired or replaced, or utilize paper poll books instead of election poll books. Repairing or replacing electronic poll books or switching to paper poll books is estimated to take between 30 minutes and two hours.
2. Ballot Marking Device Breakdown: investigates one or more ballot marking devices breaking down on Election Day at 8:15 am, the busiest time at Polling Location B. In response to a ballot marking device breakdown, election workers may choose not to repair the device(s) or attempt to repair or replace the broken ballot marking devices. Repairing or replacing ballot marking devices is estimated to take between 30 minutes and two hours.
3. Ballot Scanner Breakdown: investigates one electronic ballot scanner breaking down on Election Day at 8:15 am, the busiest time at each polling location. As each polling location only contains one ballot scanner, election workers may attempt to repair or replace the ballot scanner or offer a ballot box in which the voter may submit their ballot to be scanned at the end of Election Day. Repairing or replacing the ballot scanner and switching to using a ballot box is estimated to take between 30 minutes and two hours.

Results:

Each scenario of voting equipment breakdown is investigated:

Check-in Device Breakdown: Table 1 shows simulated voter wait times when one electronic poll book breaks down in Polling Location A and Polling Location B. When a single electronic poll book breaks down in Polling Location A and is not remedied, the average time voters spend waiting increases by 29 minutes. If the device can be repaired or replaced after 30 minutes, the average voter wait time increases by only four minutes. When an electronic poll book breaks down in Polling Location B, not repairing or replacing the device yields an average voter wait time of 45 minutes. However, repairing or replacing the device after 30 minutes results in an average wait time of 28 minutes.

Table 2 presents simulated voter wait times when all electronic poll books break down in Polling Locations A & B. In this case, voting stalls until voters can be checked in to the polling location. Therefore, election workers may attempt to have the broken-down devices repaired or replaced or switch to paper poll books. If all broken-down electronic poll books in Polling Location A are repaired or replaced after 30 minutes, the average voter wait time reaches 23 minutes. If the broken electronic poll books are replaced with paper poll books after 30 minutes, voters wait 37 minutes on average. In Polling Location B, repairing or replacing broken-down electronic poll books after 30 minutes yields an average voter wait time of 34 minutes. However, switching out electronic poll books for paper poll books after 30 minutes results in 44-minute average wait times.

Ballot Marking Device Breakdown: Table 3 shows simulated voter wait times when one ballot marking device breaks down and when four ballot marking devices break down in Polling Location B. In response to a breakdown of ballot marking devices, election workers may choose not to remedy the breakdown or attempt to have the equipment repaired or replaced. When a single ballot marking device breaks down and is not replaced, the average voter wait time is 30 minutes. If the device can be repaired or replaced within 2 hours, the average voter wait time is 27 minutes, 3 minutes lower than when devices are not repaired or replaced. However, if four ballot marking devices break down simultaneously, the average voter wait time reaches 1 hour and 37 minutes. If the broken devices can be repaired or replaced after 30 minutes, average wait times reach 28 minutes. If it takes 2 hours to repair or replace the broken equipment, the average voter wait time is 41 minutes.

Ballot Scanner Breakdown: Table 4 presents simulated voter wait times when the electronic ballot scanner breaks down in Polling Locations A & B. With only one ballot scanner in each polling location, a breakdown stalls voting until the ballot scanner is repaired or replaced or a ballot box is provided for voters. When the ballot scanner in Polling Location A breaks down and is replaced after 30 minutes, the average voter wait time is 17 minutes, a 5-minute increase compared to when no breakdown occurs. If a ballot box can be opened for ballot submission after 30 minutes, the average voter wait time is 13 minutes. Polling Location B experiences similar impacts on voter wait times when a ballot scanner breaks down. If the ballot scanner in Polling Location B can be repaired or replaced in 30 minutes, the average wait time is 31 minutes, only 5 minutes longer than when no breakdown occurs. Instead, offering a ballot box for ballot submission in Polling Location B after a 30-minute delay, the average voter wait time is 28 minutes.

Additional considerations:

- ➔ Breakdowns have a more severe impact on wait times when limited equipment is available at a polling location.
- ➔ Plans for responding to equipment breakdowns should be in place prior to Election Day. Quick response times to breakdowns can mitigate long voter wait times.
- ➔ Electronic voting equipment may offer features to voters and poll workers that cannot be replicated with analog processes, such as notifying voters of ballot errors when scanning a ballot into an electronic ballot scanner. Similarly, voters' perceptions of analog processes may cause concern or impact their confidence in their vote being counted correctly.
- ➔ The impact of equipment breakdowns may be more severe if voting turnout is high or if a small quantity of voting equipment is available.

Table 1

Check-in Device Breakdown – Single Device

		Average Voter Wait Time	
Equipment Status	**Delay**	**Polling Location A**	**Polling Location B**
No Breakdown	-	12 minutes	26 minutes
Not Repaired or Replaced	-	41 minutes	45 minutes
Repaired/Replaced	30 minutes	16 minutes	28 minutes
	2 hours	20 minutes	30 minutes

Table 2

Check-in Device Breakdown – All Devices

		Average Voter Wait Time	
Equipment Status	**Delay**	**Polling Location A**	**Polling Location B**
No Breakdown	-	12 minutes	26 minutes
Repaired/ Replaced	30 minutes	23 minutes	34 minutes
	2 hours	1 hour 5 minutes	1 hour 49 minutes
Switched with Paper Poll Book	30 minutes	37 minutes	44 minutes
	2 hours	1 hour 39 minutes	1 hour 54 minutes

Table 3

Ballot Marking Device Breakdown

		Average Voter Wait Time	
Equipment Status	**Delay**	**Single Device**	**Four Devices**
No Breakdown	-	26 minutes	26 minutes
Not Repaired or Replaced	-	30 minutes	1 hour 37 minutes
Repaired/ Replaced	30 minutes	27 minutes	28 minutes
	2 hours	27 minutes	41 minutes

Table 4

Ballot Marking Device Breakdown

		Average Voter Wait Time	
Equipment Status	**Delay**	**Single Device Breakdown**	**Four Devices Breakdown**
No Breakdown	-	12 minutes	26 minutes
Not Repaired or Replaced	-	30 minutes	1 hour 37 minutes
Repaired/ Replaced	30 minutes	27 minutes	28 minutes
	2 hours	27 minutes	41 minutes

**These results are determined from simulated voting processes. While real election data were used, these results may not directly apply to voting processes that include more or fewer steps to vote or contain processes that are particularly quick or slow to complete (e.g., ballots with many questions or ballots with few questions).*