Executive Summary

Purpose:
As part of the Simulation Modeling for an Immersive Learning Experience (SMILE) project, the Voting Process Changes module investigates the outcomes of several scenarios in which new voting equipment is incorporated in the voting process. Through computer simulation, voter wait times are estimated for voting processes transitioning from paper voting equipment to electronic devices and for alternative voting equipment or processes. Necessary adjustments in resources allocation when changing the voting process are identified and considerations when making such changes are introduced.

Voting Processes:
1. Paper-Based Voting Process: consists of a check-in step using paper poll books (i.e., 3 poll books), a ballot marking step using pen and paper at a voting booth (i.e., 13 booths) or an accessible ballot marking device (i.e., 2 devices), and ballot submission step at a ballot box (i.e., 1 ballot box).
2. Device-Based Voting Process: 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., 9 booths) or an accessible ballot marking device (i.e., 1 device), and ballot scanning at a digital ballot scanner (i.e., 1 device).

Change in Voting Process Scenarios:
1. Paper → Electronic Check-in: adopting an electronic poll book in place of a paper poll book for voter check-in.
2. ID Requirement Policy at Check-in: compares processes with differing voter ID requirements at check-in.
3. Paper → Electronic Ballot Marking: adopting ballot marking devices in place of hand-marked paper ballots at voting booths for ballot marking.
4. Ballot Box → Ballot Scanner: adopting precinct ballot scanners in place of ballot submission to ballot boxes.
5. Existing → New Ballot Scanner: using an alternative ballot scanner for ballot submission.

Results:
Using simulated voter wait times, the effect of adjusting resource allocations for reducing long lines and voter waits are determined for each change in voting process scenario. Below are five tables showing the effect of each strategy on voter wait times per voting process and per voter arrival pattern.

Paper → Electronic Check-in: Table 1 findings show that the transition from using paper poll books to electronic poll books for check-in increases the average wait time when the number of resources allocated is not adjusted. In this instance, the average voter wait time increases by 144 minutes. In order to reduce voter wait times after the transition to electronic poll books, a total of 5 electronic poll books are required. With this adjusted allocation, average voter wait times are 28 minutes.

ID Requirement Policy at Check-in: Table 2 findings show that check-in processes with a policy requiring no ID to be presented at check-in experiences longer average voter wait times due to the longer processing time at check-in. In this scenario, the voter wait time for a process requiring an ID to be presented at check-in is 18 minutes while a process requiring no ID to be presented has a wait time of 188 minutes on average. In order to reduce voter wait times for the simulated polling location that requires no ID to be presented, 5 electronic poll books are required to achieve an average voter wait time of 28 minutes.

Paper → Electronic Ballot Marking: Table 3 indicates that moving from hand-marked ballots at voting booths to ballot marking devices increases average voter wait times from 18 minutes to 276 minutes, a 4.3 hour increase. In order to reduce voter wait times, a total of 14 ballot marking devices and 2 accessible ballot marking devices must be allocated to the polling location. With this adjusted resource allocation, voter wait time may be reduced to 23 minutes.

Ballot Box → Ballot Scanner: Table 4 findings show that using a ballot scanner in place of a ballot box slightly increases average voter wait time in the explored scenario. This process change increases the average voter wait time by 3 minutes, from 18 minutes to 21 minutes. As such, this scenario requires no adjustment in resource allocation.

<u>Existing → New Ballot Scanner</u>: Table 5 indicates that moving from one ballot scanner to another has no effect on voter wait times and does not require an adjustment to resource allocation. Regardless of ballot scanner, the voter wait time remains 18 minutes with the initial resource allocation.

Additional considerations:

➔ Electronic voting equipment has a likelihood of breaking down or having errors that delay the voting process. When adopting a new electronic voting device or moving from paper systems to electronic ones, it is critical to know the expected rate of breakdowns and errors. With these values known, additional electronic resources may be desired to mitigate delays caused by equipment failure.

➔ Policy and election law may dictate how voting processes must be performed. Certain policy changes may lead to changes in processing times which affect overall voter wait times. Resources must be allocated with such policies in mind.

➔ Voting process changes that dramatically alter processing times are likely to require adjusted resource allocations. In this module, cases where no adjustment in resources were needed experienced insignificant changes in processing times.

➔ Increasing resources in a polling location may be challenging or impossible to implement due to the physical size of a polling location. Additional attention may be needed when laying out and setting up voting equipment in a polling location to maximize the number of devices that can fit in the available space. In addition to physical capacity, electrical capacity may limit the number of electronic devices that can be set up within a polling location.

Table 1

Paper → Electronic Check-in Results

	Resource Allocation			Average Wait Time (minutes)
Voting Process	**Check-ins**	**Voting Booths**	**Ballot Boxes**	
Paper Check-in	3	13	1	18
Electronic Check-in	3	13	1	162
Adjusted Resource Allocation				
Electronic Check-in	5	13	1	28

Table 2

ID Requirement Policy at Check-in Results

	Resource Allocation			Average Wait Time (minutes)
Voting Process	**Check-ins**	**Voting Booths**	**Ballot Scanners**	
ID Required	3	9	1	18
No ID Required	3	9	1	188
Adjusted Resource Allocation				
No ID Required	5	9	1	28

Table 3

Paper → Electronic Ballot Marking Results

	Resource Allocation				Average Wait Time (minutes)
Voting Process	**Check-ins**	**Voting Booths**	**Accessible Ballot Marking Device**	**Ballot Scanners**	
Paper Ballot Marking	3	9	1	1	18

Electronic Ballot Marking	3	9	1	0	276

Adjusted Resource Allocation

Electronic Ballot Marking	3	14	2	0	23

Table 4

Ballot Box → Ballot Scanner Results

Voting Process	Resource Allocation			Average Wait Time (minutes)
	Check-ins	**Voting Booths**	**Ballot Submission**	
Ballot Box	3	13	1	18
Ballot Scanner	3	13	1	21

Table 5

Existing → New Ballot Scanner Results

Voting Process	Resource Allocation			Average Wait Time (minutes)
	Check-ins	**Voting Booths**	**Ballot Submission**	
Existing Ballot Scanner	3	9	1	18
New Ballot Scanner	3	9	1	18

*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).