Preliminary findings on digital tools use in Milwaukee Public Schools

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Research objectives

1. How are the digital tools being **implemented in practice***?*
2. How do the digital tools influence **student academic progress and outcomes**?
3. What **policies and strategies at the district, school and classroom levels** would improve the effectiveness of digital tools?

Research Overview: Data and Methods of Analysis

- Quantitative analysis of Edgenuity data linked with MPS student record data
  - Over 1.6 million (2014-15) and 1.5 million (2013-14) Edgenuity gradebook-session records with information on course-taking, activities completed and performance in Edgenuity courses linked to MPS student records that include demographic and test score data
  - Descriptive statistics, regression analysis, fixed effects models and matching analysis
- Qualitative analysis of data from observations of instructional sessions that include the use of digital tools, teacher interviews and document analysis
  - 46 total observations of technology (Edgenuity) use (31 conducted in 9 MPS schools in Spring 2016; 15 observations conducted in Spring 2015 in 2 MPS schools) using a standard observation instrument; observations of 2 PD sessions; analyzed using Nvivo software

Linked Edgenuity and MPS Data

KEY PRELIMINARY FINDINGS

Findings from analyses of linked Edgenuity-MPS data: student participation

Who is more likely to use Edgenuity (among MPS students, 2014-15)?

- Students falling *well below* or *significantly below target* in their fall academic (MAP) performance
- Students who are absent more often
- Free-lunch eligible students
- Students in 10-12 grades (compared to 9th graders)

Alternatively:

- English language learners (ELLs) and students with disabilities are significantly less likely to use Edgenuity (when controlling for their MAP test score performance, which is significantly lower compared to other MPS students)

Table 1: Who in MPS is using Edgenuity? Odds of using Edgenuity					
	2014-15			2013-14	
Student characteristics	Odds (higher)	Odds (lower)	Odds for students in Edgenuity H.S. only	Odds	Odds for students in Edgenuity H.S. only
Female		**-13%**	**-16%**	**-18%**	**-19%**
Asian (reference category for race: Black)		**-63%**	**-66%**	**-64%**	**-56%**
White				**-33%**	**-13%**
Hispanic				**-22%**	**-14%**
English language learner		**-37%**	**-19%**	**-22%**	**-32%**
Free lunch eligible	22%		34%		
Student with disabilities		**-35%**	**-28%**	**-12%**	
Percent absent	127%		137%	708%	342%
Grade 10 (reference category: Grade 9)	296%		128%	275%	102%
Grade 11	507%		255%	604%	268%
Grade 12	278%		199%	311%	124%
Fall math (not tested)	94%		125%		
On or above target: fall math		**-61%**	**-46%**		
Well below target: fall math	43%		34%		
Significantly below: fall math	51%		24%		
Fall reading scale score				7%	
Fall math scale score				**-18%**	**-18%**

Findings from analyses of linked Edgenuity-MPS data: course-taking and academic progress

Student performance in Edgenuity courses (2014-15 and 2013-14)

- MPS students perform least well in math and language arts course and best on electives
- ELLs and students with special needs scored significantly lower than other Edgenuity users on quizzes and tests, and their course failure rates were significantly higher
  - This pattern differed from 2013-14 for ELLs, who scored similarly compared to other MPS students using Edgenuity; this may relate to differences in their course-taking across these years
    - In 2014-15, ELLs were significantly more likely than non-ELLs to take courses in language arts, math, science and social studies (vs. elective courses); the opposite was true for ELLs in 2013-14: they had significantly lower odds of taking these courses (relative to electives)

Table 2: Student performance on Edgenuity course quizzes and tests by course subject						
	Average quiz or test scores in Edgenuity courses (n=# observations)					
Type of Edgenuity course	All Edgenuity users	n	English language learners	n	Students with special needs	n
2014-15 school year						
Electives	67.20	89,752	59.62	3,054	62.48	12,038
Language Arts	55.50	75,943	45.89	4,029	47.47	13,554
Math	53.00	83,140	48.22	5,417	48.11	11,546
Science	58.53	57,254	54.84	3,691	55.51	11,145
Social studies	61.04	86,457	57.23	4,516	59.23	12,459
2013-14 school year						
Electives	69.15	78,631	70.08	3,422	65.78	7,861
Language Arts	61.09	71,725	63.34	2,647	57.35	9,200
Math	50.91	87,985	50.13	3,171	44.80	16,117
Science	59.76	56,194	59.38	2,564	54.90	9,231
Social Studies	59.41	104,984	63.35	3,278	58.00	13,799

A score of 60 is needed (on a quiz or test) to pass a course.

Findings from analyses of linked Edgenuity-MPS data: Factors influencing Edgenuity course performance

What malleable factors influence student course outcomes in Edgenuity (controlling for student characteristics, fall MAP performance, grade and school)?

- Longer **session durations** are positively related to course outcomes—quiz/test scores increase (by 0.114 points in 2014-15 and 0.081 points in 2013-14) for each additional *minute*, and course failure rates are 0.045% lower in 2014-15 and 0.088% lower in 2013-14 for each additional minute
- Longer **% of session time spent idle** lowers quiz/test scores (by -6.16 points in 2014-15 and -10.81 points in 2013-14), and course failure rates are 20% higher for each *percentage point increase* in average idle time in 2014-15 (and 8.1% higher in 2013-14)
- An additional **activity completed per day** increases quiz/test scores by 0.747 points in 2014-15 and 0.652 points in 2013-14; course failures are 0.38% lower in 2014-15 and 0.42% lower in 2013-14 for each additional activity completed per day
- For each additional minute in **total session time**, course failure rates are lower by 4.9% in 2014-15 and by 5.6% in 2013-14

Findings from analyses of linked Edgenuity-MPS data: Effective use of Edgenuity

Who is using Edgenuity less effectively to make academic progress?

- Students with special needs, eligible for free lunch, with poorer fall MAP performance and absent more often completed significantly fewer activities per day and had significantly shorter session durations
- Students absent more often also spent more time idle while logged into Edgenuity, and male students were also idle significantly more than female students on average
- Free-lunch eligible students, those "well below target" on fall MAP scores and students absent more often have significantly lower total active time in Edgenuity
- Bradley Tech stood out in 2014-15 as having students with significantly more activities completed per day and longer session durations and less idle time

We did not find significant associations between Edgenuity use and MAP test scores/gains

Patterns in Classroom Observations

KEY PRELIMINARY FINDINGS

Instructor role and capacity

- Instructors had a range of capacity related to:
  - Technical support
  - Navigating the Edgenuity platform
  - Content knowledge
  - Pedagogic strategy specific to blended environments
- Instructors in labs had similar role in relation to:
  - Providing tech support
  - Administrative responsibilities
  - Redirection and behavior management
  - Occasional content support
  - And student support in general

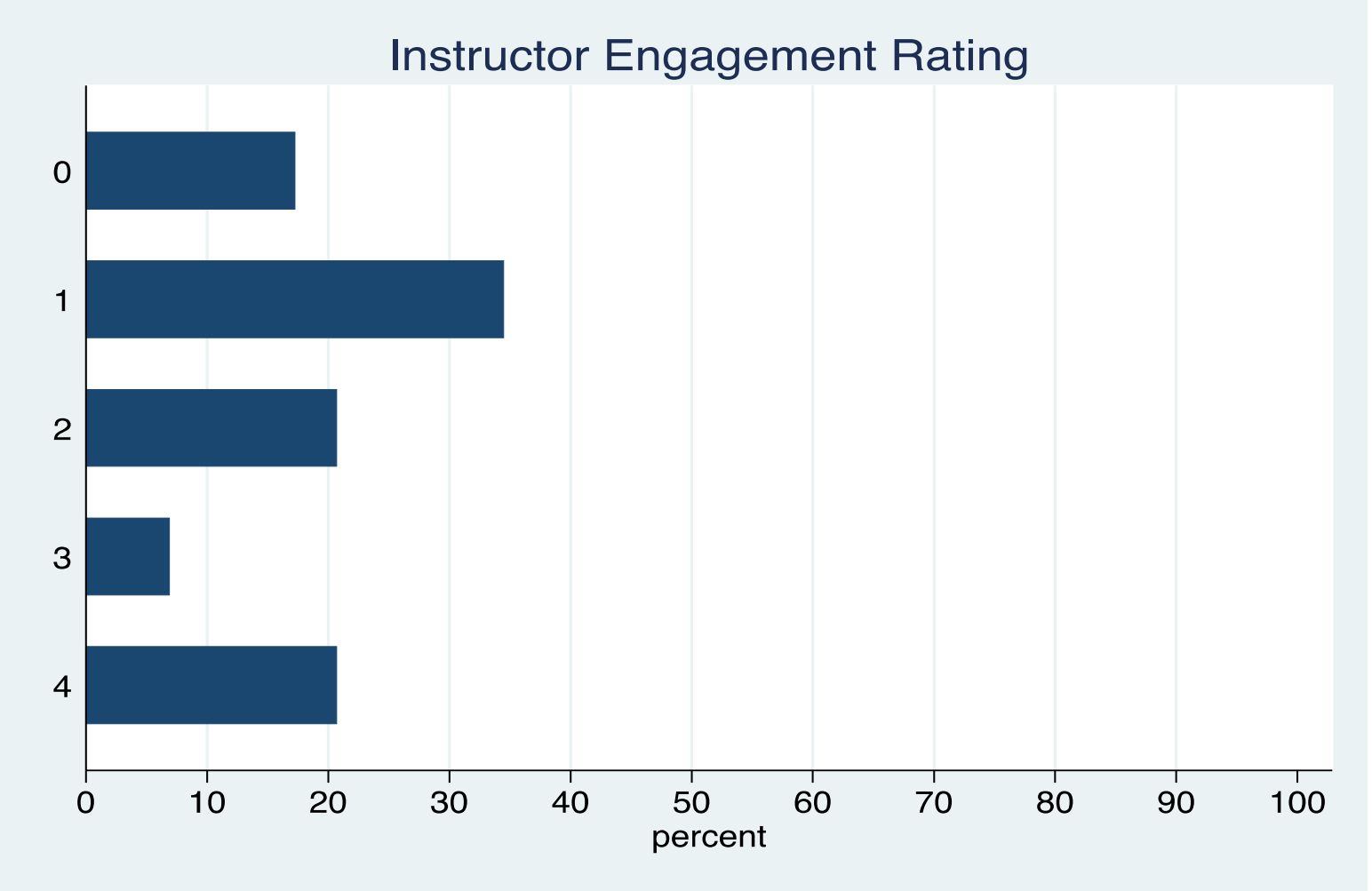
"After telling a story of a student who had come in crying on a Monday, wanting to talk to him because a family member had been shot, an instructor said: 'I'm their administrator, counselor, teacher. This is their home.'"

Highly-rated examples: The teacher was fully engaged in the work of reviewing quizzes for students before they were submitted.

The teacher was up working with students at his computer or walking around to help others the entire time.

Low-rated examples: The classroom lab instructor walked to the back of the room where the student was sitting but did not notice her lack of engagement or address her use of the tool.

The instructors did not get directly involved in the student's instruction. Some instructors were walking in the classroom, trying to encourage students to get back to work. This student tried to get one instructor's attention but failed.



[4] All instructors have full engagement in instruction.
[3] Instructors are engaged in most of the instruction.
[2] Instructors are engaged in some of the instruction.
[1] Instructors rarely are engaged in instruction.
[0] Instructors are not engaged in instruction.

Access and technology

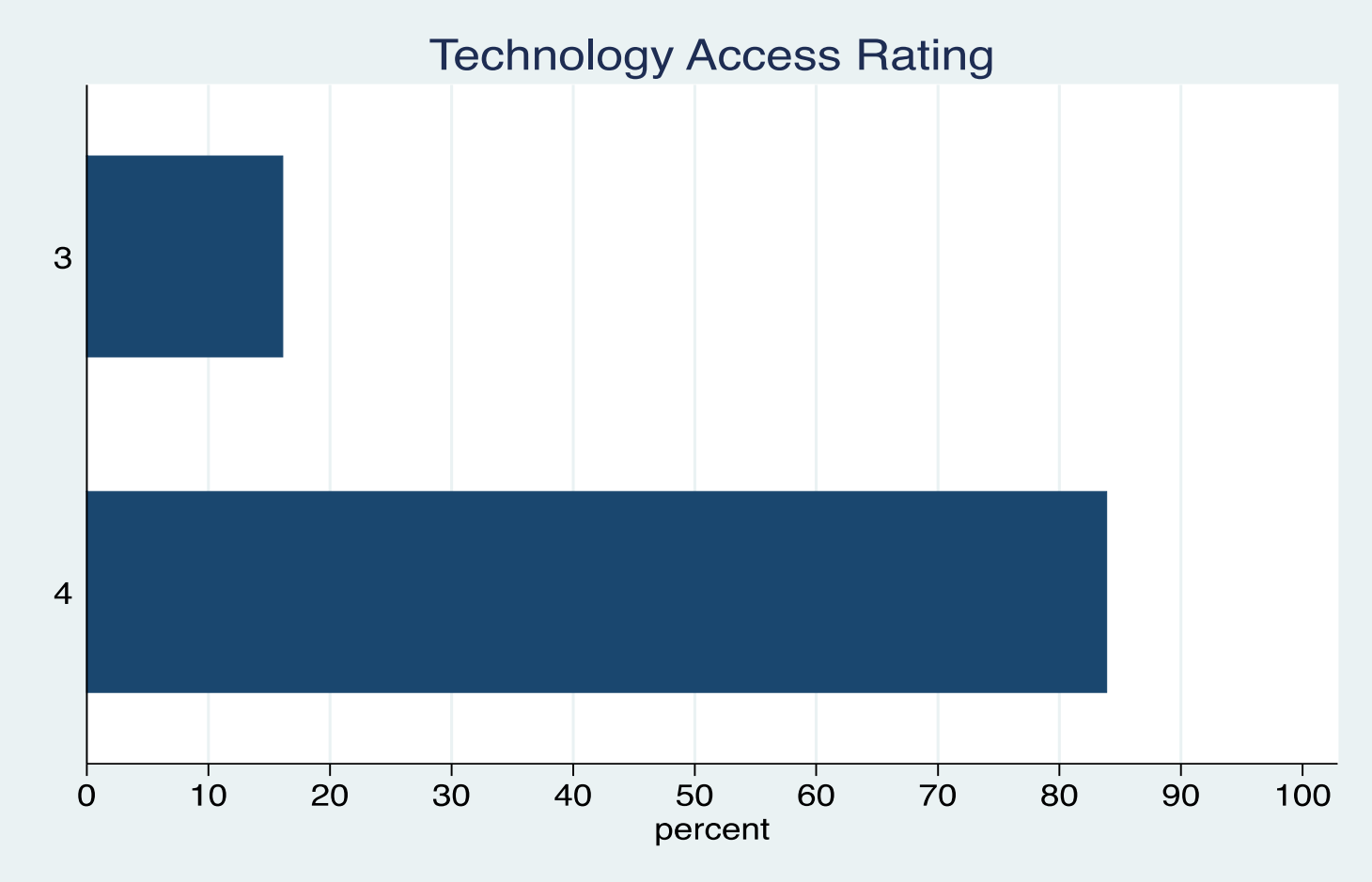
Focus areas: reliable software, reliable hardware, internet connectivity, equitable access for students with disabilities and ELL students, challenges of tech support

- Technology was functional for students in 90.3% of observations (2016)
  - Time lost due to problems with functionality was under 1 minute on average, and averaged 4.67 minutes among the 9.7% of observations that recorded technical problems
- A "spectrum" of disruption:
  - Barriers based simply on students' ability to use the technology (e.g. type on a keyboard)
  - Technical challenges impeding or slowing down instruction (e.g., slow internet making students wait for videos to load)
  - Stopping instruction completely (e.g., software crash; log-ins not working)
- Burden of tech support falls most heavily on adult closest to the digital tool

Highly-rated (4) example: The student had full access to the internet and the Edgenuity program during the observation.

Lower-rated (3) examples: The internet was a little slow; other students in the classroom were having problems with their videos freezing up during the lectures.

The technology worked most of the time for the student, although she did have a problem re-logging into the account after finishing the quiz.



[4] Students have full access to the instructional setting throughout the session.
[3] Students have access to the instructional setting throughout most of the session.
[2] Students have access to the instructional setting throughout some the session.
[1] Students had multiple problems accessing the instructional setting throughout the session.
[0] No students were able to access the instructional setting.

Student engagement

- Students were off task 12.52 minutes on average (or 31.1% of total time observed)
- Instructors noted that students in grades 11 and 12 tend to be more motivated than those in grades 9 and 10
- "Digital citizenship", or whether students are using the digital tools in the intended ways, varied considerably but was often an issue with at least some students in an observed session

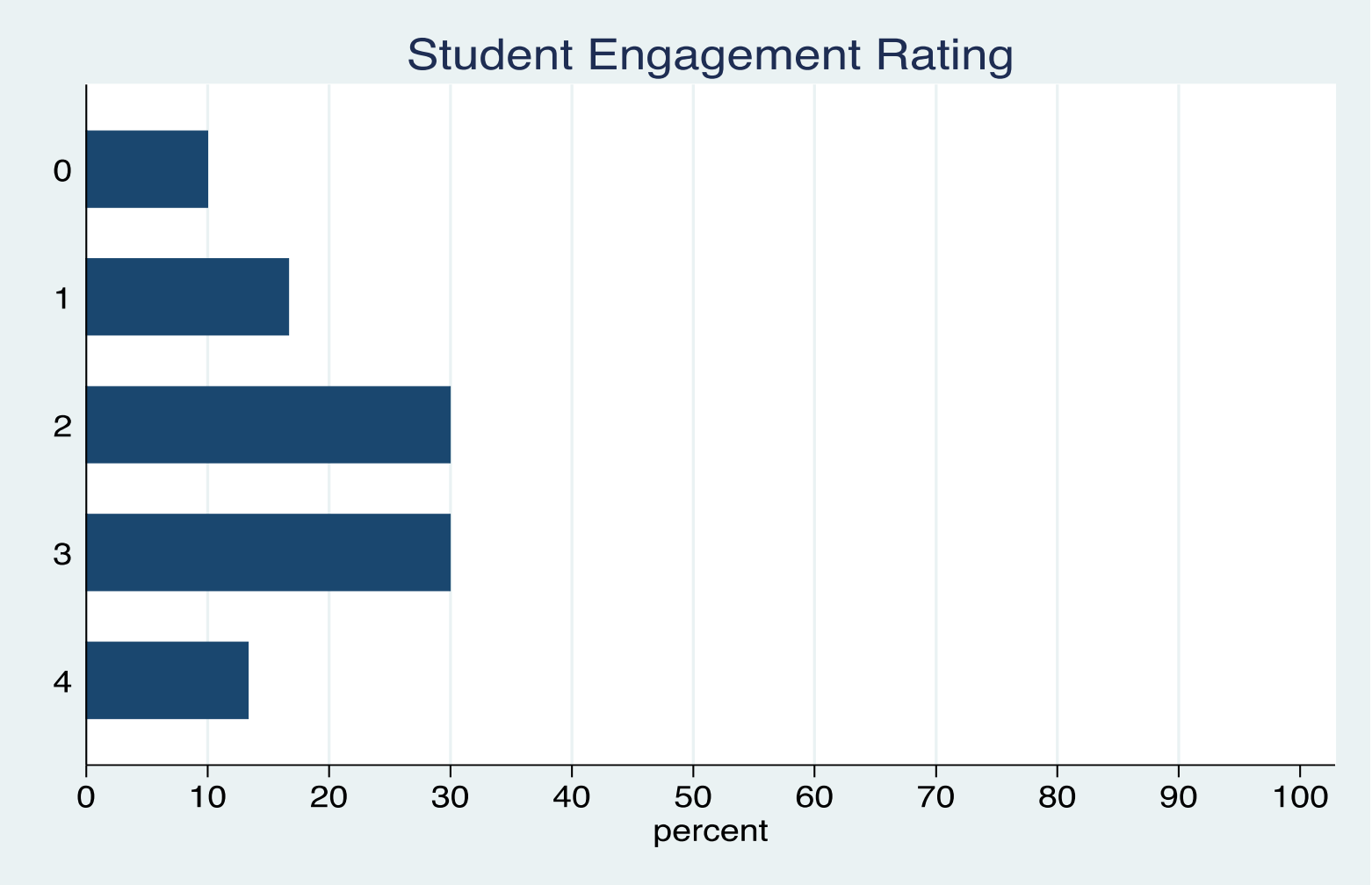
> *"The observed student was watching the video lectures and reading the online articles during the session. However, he also had his phone in hand and he was checking that constantly."*

Highly-rated examples: The student was completely engaged in the session, reading the screen, taking notes, trying to figure out algebra problems on a quiz.

The student works continuously, taking detailed notes.

Low-rated examples: The student made little to no effort to work on her course in Edgenuity.

The student ran the slides and video with no headphones (so didn't hear the lecture itself) and was on his phone for 40 minutes not even looking at the screen. Occasionally he talked to the student next to him. He sat on the same slide for periods of time (5-6 minutes) before clicking it. He did click when the teacher walked by. Two other girls in the corner were talking constantly and not working.



[4] Students have full engagement in instruction.
[3] Students are engaged in most of the instruction.
[2] Students are engaged in some of the instruction.
[1] Students rarely are engaged in instruction.
[0] Students are not engaged in instruction.

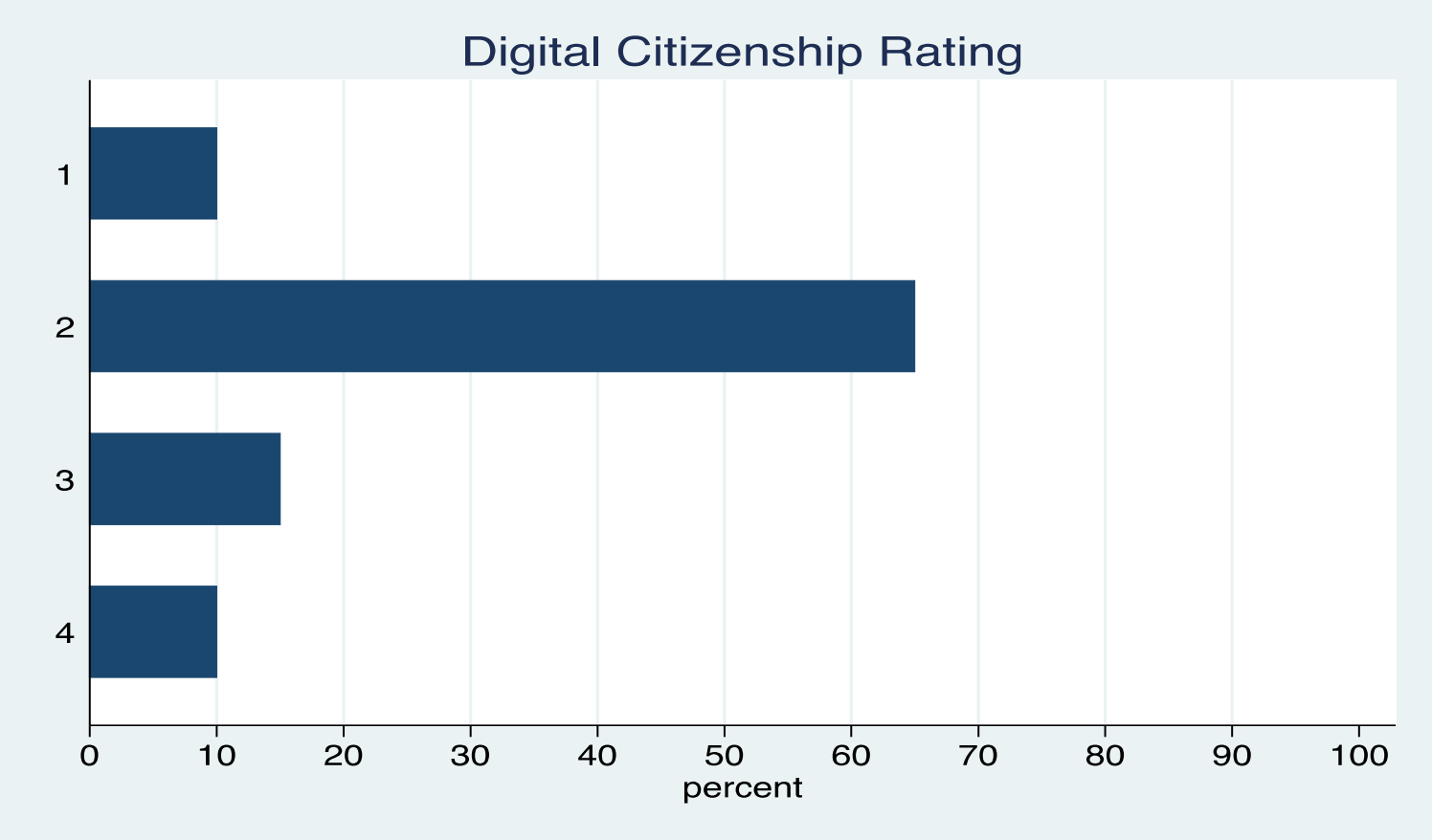
Highly -rated examples: The student stayed focused on using the technology appropriately.

The student was using the desktop in the way intended, but did not use headphones to listen to the video lecture.

Lower-rated examples: The student was not using the laptop for instruction and was texting on her phone throughout the session.

Some students were visiting music websites on their desktops and started talking with other students.

Some students were playing games on the computer.



[4] All students are using the technology as intended by the instructor and/or instructional program.
[3] Most students are acting responsibly and using the technology in intended ways, and there are no apparent distractions.
[2] Some students are using technology in unintended ways but distractions are minimal.
[1] A sizable fraction of students are using the technology in unintended ways and creating distractions in the environment.
[0] Most students are violating intended uses of the technology (e.g., switching to games, using for inappropriate material) and creating distractions in the environment.

Recommendations

IMPROVING THE USE OF DIGITAL TOOLS IN MPS

Preliminary recommendations from qualitative and quantitative analyses

- Based on the quantitative analysis, we recommend further investigating the following:
  - How are students guided in their Edgenuity course-taking (e.g., electives vs. other subjects)? What determines whether ELLs choose Spanish language courses?
  - What policy, organizational and instructional factors at school and/or classroom levels contribute to differences in completed activities per day, session duration and idle time among Edgenuity users?
  - What approaches or strategies are used in MPS schools (where Edgenuity is being used) to identify students who are falling behind in active system time and successful completion of courses required to graduate?

Preliminary recommendations from qualitative and quantitative analyses

We recommend considering the following related to *instructor experience and certification*:

- *Content knowledge*:
  - Alternative education certification to have constant, broad coverage
  - How to find a cost-efficient way to have advanced content knowledge available in the classroom; are there economies of scale to be realized across MPS (e.g., a "call center" in MPS that is staffed by content people who also know the Edgenuity platform?)
- Edgenuity doesn't make specific accommodations for *students with disabilities*
  - Option A: A lab instructor should have special education training in order to make appropriate accommodations, or
  - Option B: Regular access to a special education teacher elsewhere in the school who also has been trained on Edgenuity platform (less resource-heavy than Option A)
- Access to staff trained on Edgenuity to support *English language learners* when needed

Preliminary recommendations from qualitative and quantitative analyses

We recommend considering the following related to instructor *training*:

- *Tech support*
  - Needs assessment with current Edgenuity teachers on 3-4 specific areas they need training on (apart from Edgenuity platform itself)
  - MPS tech support conducts training
- *Pedagogic* training on Edgenuity (not just on how to access data and navigate platform)
  - Student engagement in blended settings
  - Facilitating higher order thinking via Edgenuity
  - Incorporating offline materials

Next steps in the research and discussion

Next steps for MPS digital tools research

WT Grant award provides funding for continued collaboration through July 2019

- WTG Foundation focus: Can digital tools be used effectively to close opportunity and achievement gaps?

Next steps:

- Obtaining, linking and analyzing 2015-16 Edgenuity data and MPS student records/test scores
- Data collection for 2016-17
  - Obtain online tutoring vendor data for digital tools use in elementary schools
  - Observations of Edgenuity and online tutoring
    - *For discussion: process for scheduling observations; potential for purposive sampling*
- Ongoing analysis of prior years of linked Edgenuity-MPS student record data to discern patterns in use of Edgenuity and to examine individual student progress for multi-year users
  - We would like to examine high school graduation/completion and to explore the possibility of obtaining data to examine student post-high school/labor market outcomes

Edgenuity-MPS data match rates and potential for improvement

- We linked Edgenuity session and gradebook data files (over 1.6 million records) with MPS student data in 2014-15 school year; we matched 86.6% of these sessions with MPS student records (a total of 96,853 MPS student records linked with the Edgenuity data, including 5,282 Edgenuity users)
- For the 2013-14 school year, we linked over 1.5 million Edgenuity session-gradebook records to MPS student records with a match rate of 81.4%; 78,770 student records, 4,872 for Edgenuity users
- There were a small number of high schools/educational settings for which we have lower Edgenuity-MPS match rates; we recommend investigating this further:
  - District summer school (match rate: 47.4%, 2014-15; 36.9%, 2013-14)) and district virtual courses (26.9%, 2014-15; 3.3%, 2013-14)
  - Transition H.S. (51%, 2014-15; 55.3%, 2013-14)
  - Other schools with a less than 70% match rate: Project Stay (68.8%, 2014-15); Groppi and Milwaukee Co. Youth Education Center (2013-14 only) and Nova

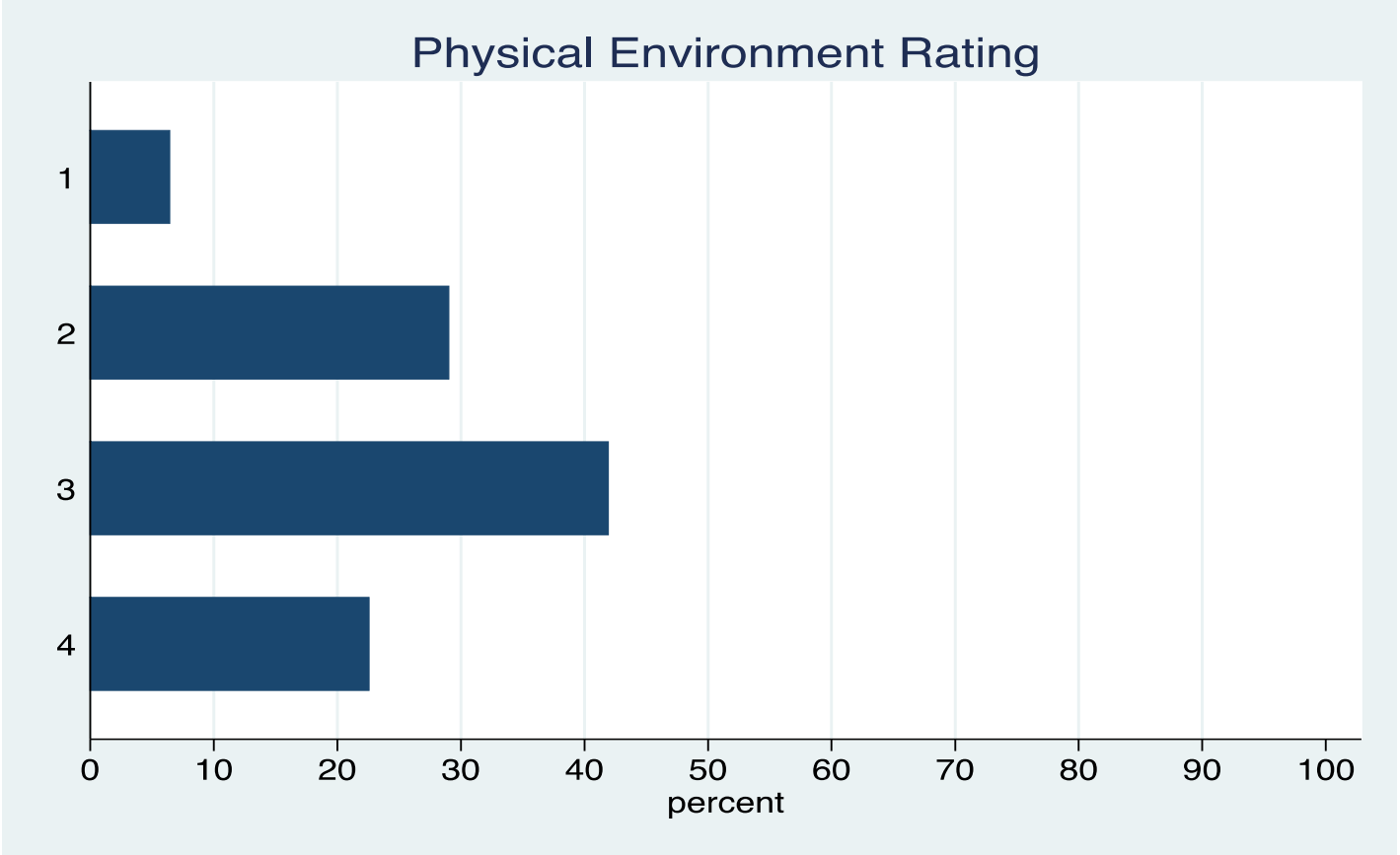
Additional areas of focus in observations

- Physical environment
- Curricular content
- Instructional model
- Interactions
- Assessment

Highly-rated example: This was a large computer lab with 40 computers, 1/2 had students using them. It was bright, clean and organized with couches in the middle of the room. Mostly quiet during the period. The teacher was there for questions.

Low-rated examples: Limitations of the physical environment were due to the student's (inappropriate) use; student had the opportunity for access (to technology) at all times.

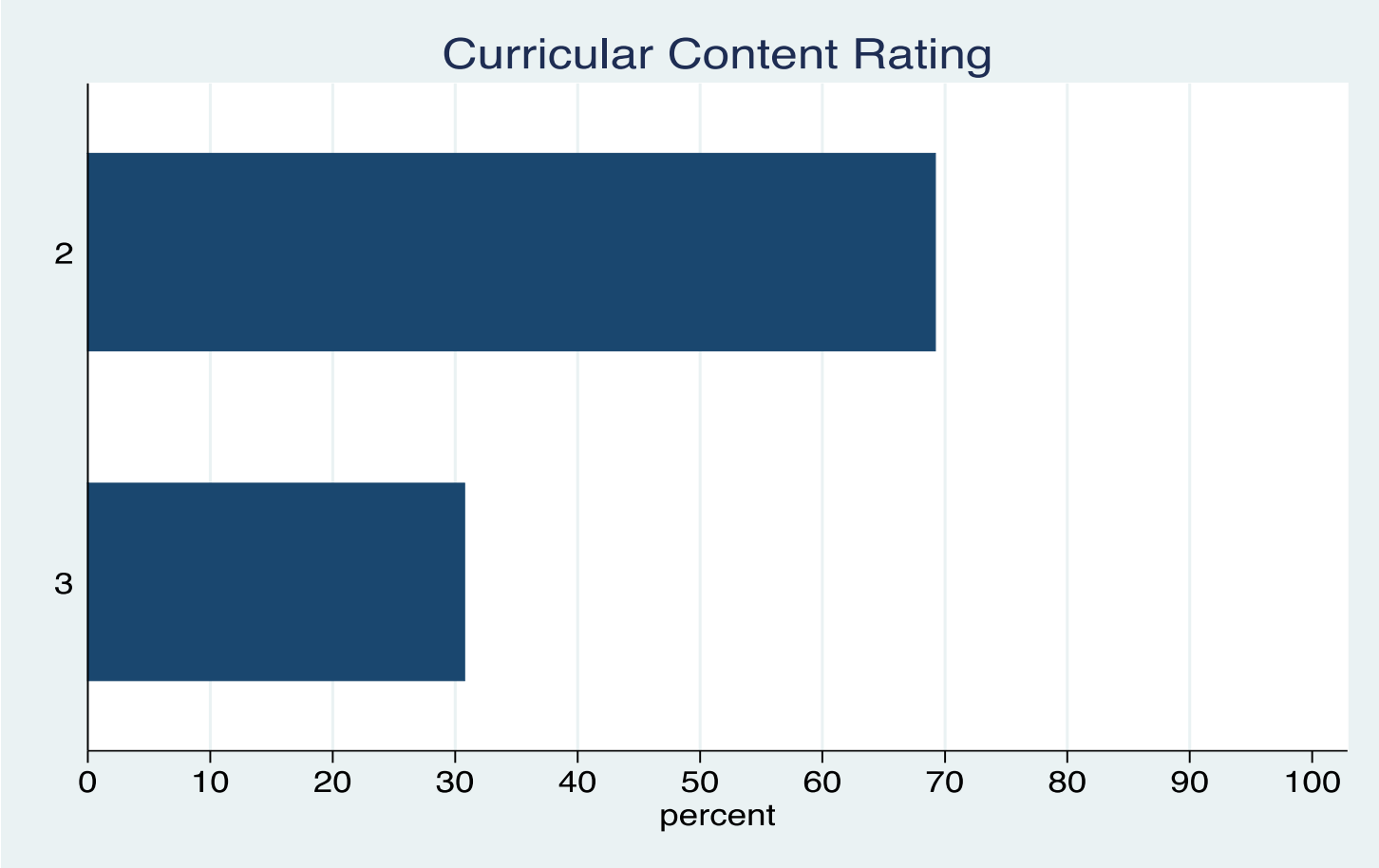
A lot of students were talking or walking around, making a lot of noise.



[4] Students have full access to the instructional setting throughout the session.
[3] The physical environment presents occasional or partial enhancements to quality learning opportunities.
[2] The physical environment does not get in the way of quality learning opportunities, but does not contribute to them.
[1] The physical environment presents occasional or partial barriers to quality learning opportunities.
[0] The physical environment is a significant barrier to quality learning opportunities.

Higher-rated (3) example: The student was taking a lesson that talked about teens and risk factors relevant to high school students. The video talked about different risk factors and possible interventions. The content was sequenced and structured.

Lower-rated (2) example: The student was working on the historical context of a novel. There was text and some photos, then taking notes based on outlined text on the screen. The curricular content is structured, and learning objectives made clear. It is content heavy and a lot for students to take in. It does not relate to students own communities and lives, and does not adapt within the session to students' particular needs (with the exception of teachers being able to have students repeat).

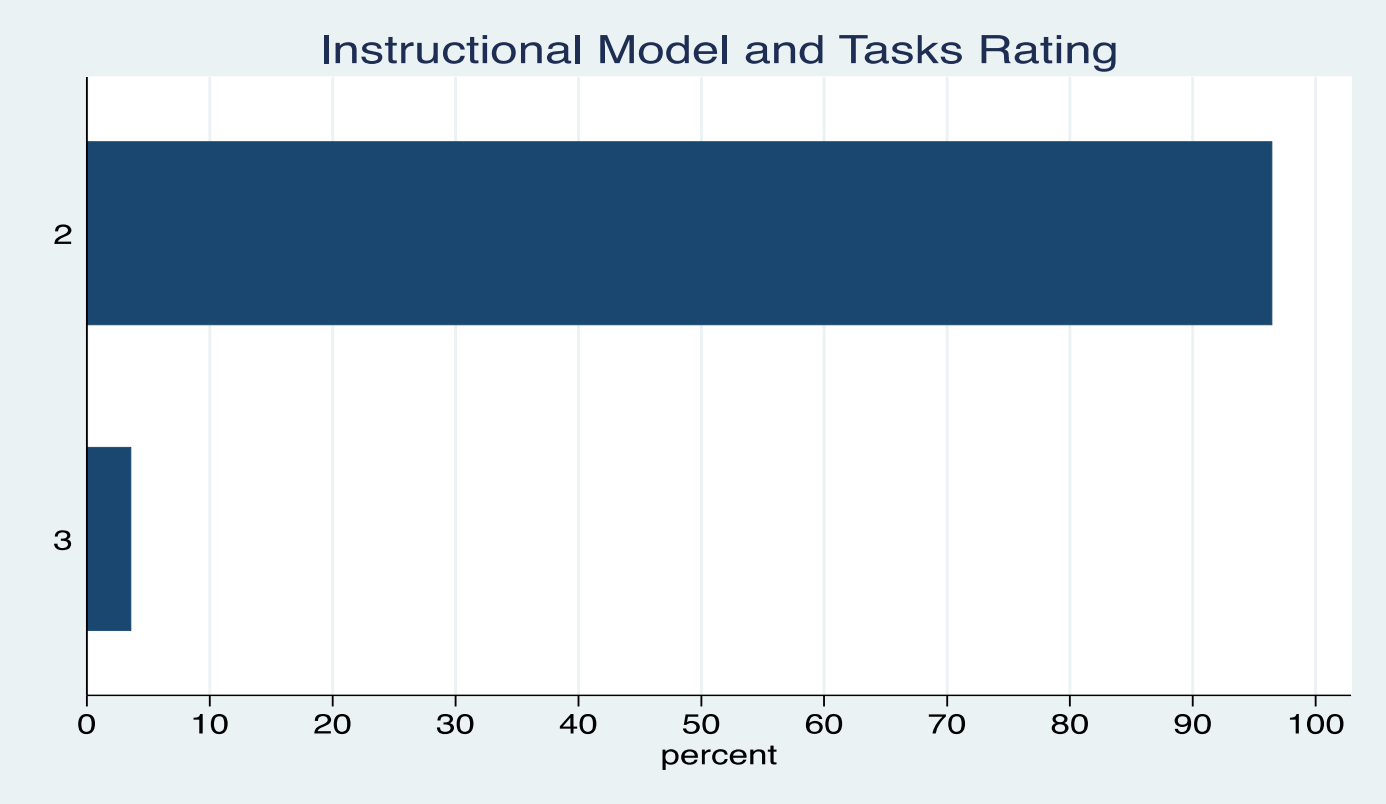


[4] Curricular content and structure observed to create quality learning opportunities throughout session.
[3] Curricular content or structure observed to create quality learning opportunities throughout session
[2] Curricular content or structure observed to create quality learning opportunities occasionally during session.
[1] Neither curricular content nor structure create or inhibit quality learning opportunities.
[0] Curricular content or structure inhibit quality learning opportunities throughout session.

Examples: Student controls pace of lesson, but this seems to be the only adaptation.

The student appeared to struggle when given the opportunity to do practice calculations in the system (enthalpy of reactions); it was unclear what opportunity the software might offer to support the student in performing the calculations.

Students primarily asked to listen, recite, demonstrate, occasionally apply. Not much critical thinking involved, or problem solving. The digital tool is used to house the instruction, not for communication or application of concepts.

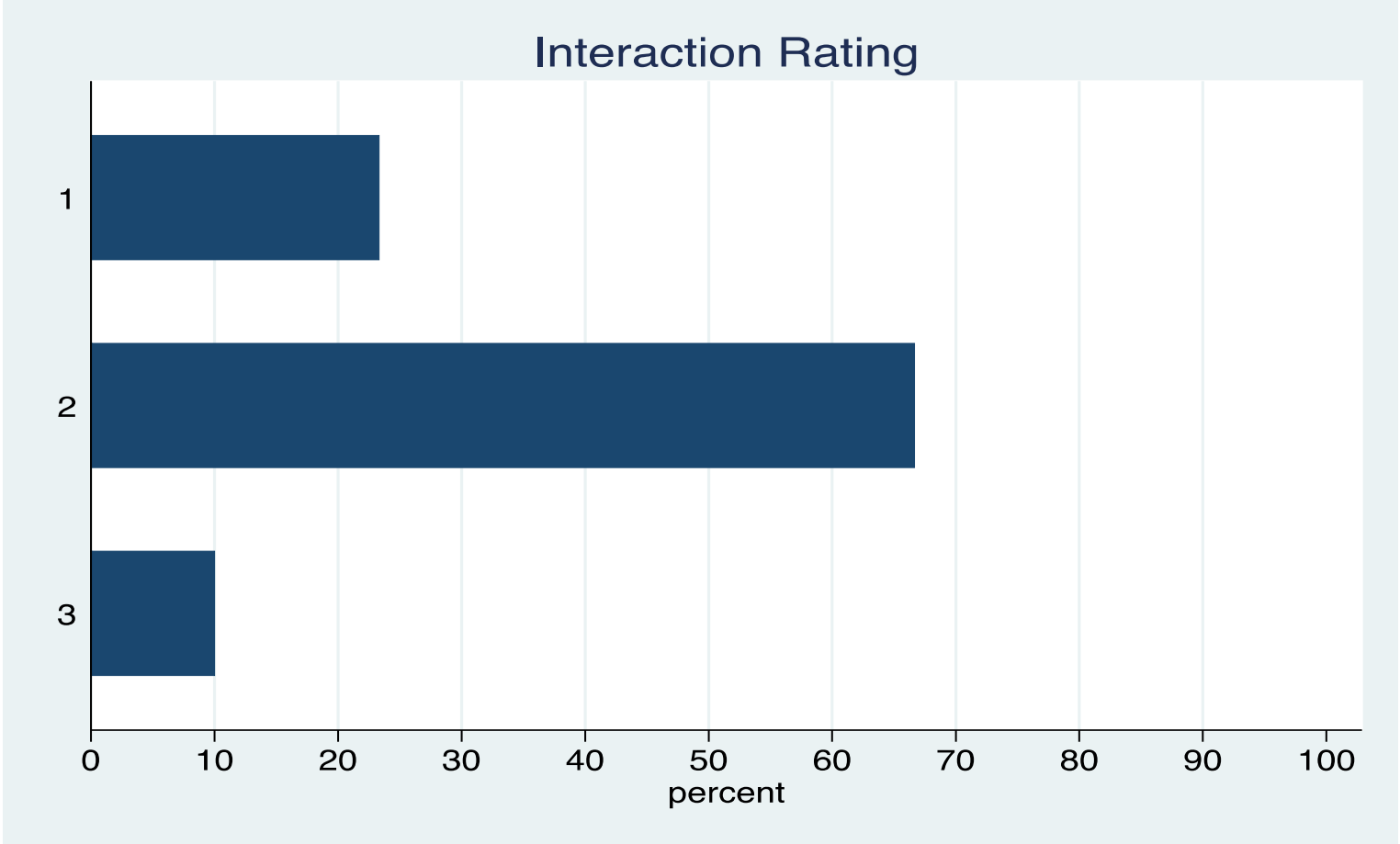


[4] The instructional model and tasks consistently facilitate quality learning opportunities and adapts to observed (or known) student needs.
[3] The instructional model and tasks mostly facilitate quality learning opportunities and adapts to observed (or known) student needs.
[2] The instructional model and tasks facilitate some quality learning opportunities but do not adapt to observed (or known) student needs.
[1] The instructional model and tasks do not facilitate quality learning opportunities and do not adapt to observed (or known) student needs.
[0] The instructional model and tasks inhibit quality learning opportunities and do not adapt to observed (or known) student needs.

Higher-rated example: Students are interacting with software through clicks and typing. The teacher did 8-10 walk-arounds and would talk to specific students either in response to questions or not, as well as related to personal issues and coursework.

Lower-rated examples: The student was playing games on the laptop most of the time. Only one teacher stopped by to remind the student go back to work, but the student went on with playing the games.

The student went to the teacher to check his answers for about 1 minute. Other than that, he was working on the computer and playing on his cell phone.



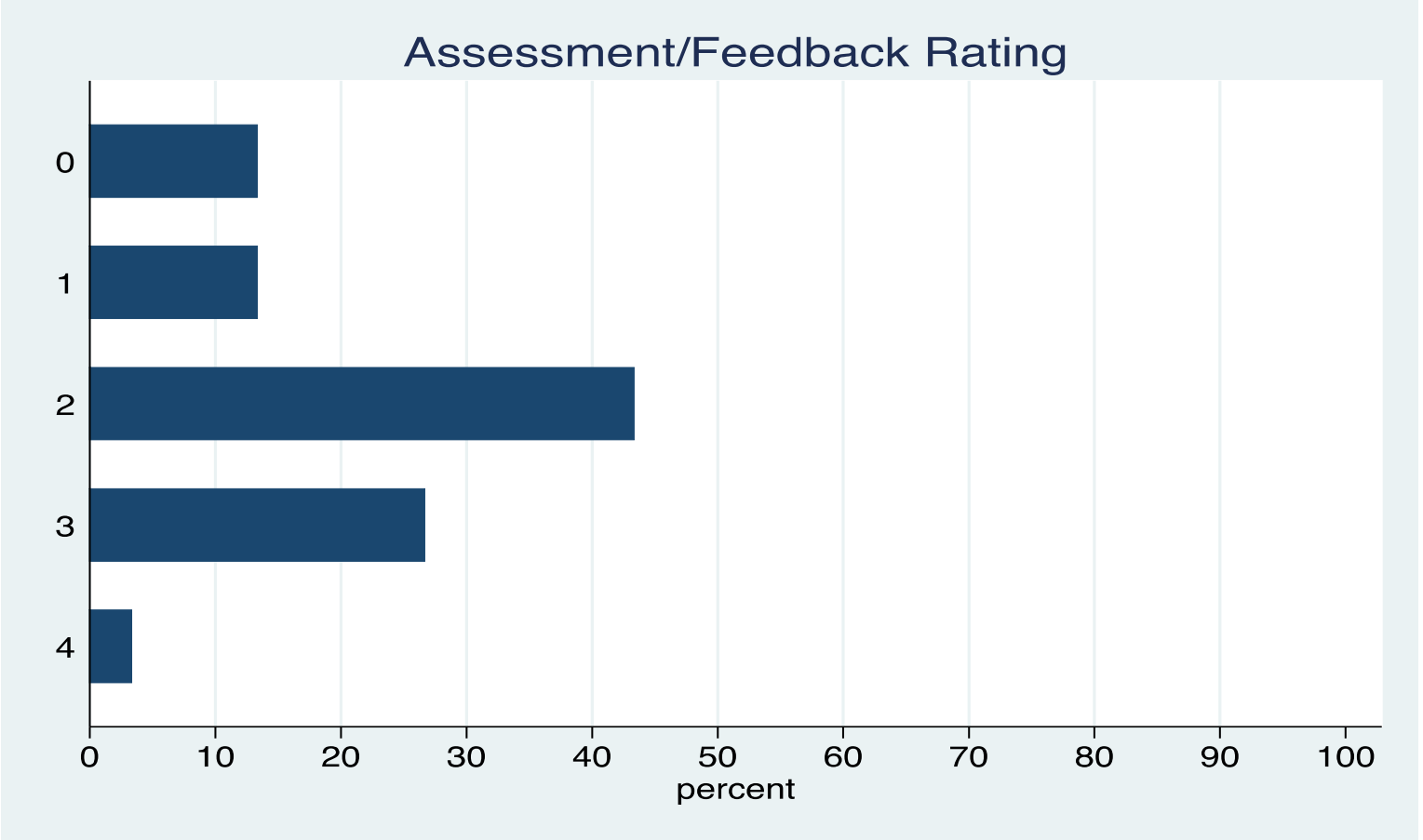
[4] Instructors and resources have constant, constructive interaction with students.
[3] Instructors and resources mostly have constant, constructive interaction with students.
[2] Instructors or resources have some constructive interaction with students.
[1] Instructors and resources have no constructive interaction with students.
[0] Students, instructors or resources have destructive interaction with one another.

Higher-rated examples: Student was assessed during the lesson on the instructional material; checked her notes and appeared to thoughtfully consider the assessment questions. Received a score of 60% and returned to the lesson to continue her work.

The student was taking a multiple choice quiz for most of this session. She had the teacher review the quiz to see how she did; she then fixed some questions she had wrong, and then he submitted it.

Low-rated example: The limitation of the assessment appeared to be on the student side; the student was not making a serious effort to use Edgenuity and complete the assessment.

The student only took the quiz for about 1 minute then quickly switched back to lecture so he could keep playing with his cell phone.



[4] Student learning is assessed frequently in varied formats that facilitate learning opportunities.
[3] Student learning is assessed frequently in a single format that facilitates learning.
[2] Student learning is assessed once in a way that facilitates learning opportunities
[1] Student learning is assessed during the session but is not constructive towards learning.
[0] Student learning is not assessed during the session.

Linked Edgenuity Program-MPS Student Record Data

ADDITIONAL ANALYSIS AND FINDINGS

Improving the effective use of Edgenuity

- Table 3 shows completed activities per day and average session duration by student subgroups using Edgenuity
  - In addition to Bradley Tech, Bay View, Madison, North, Reagan, Story School and Transition H.S. also stood out as having students with both significantly higher numbers of completed activities per day and longer session durations on average
- Total *active* time was also examined across all sessions for a given student (up to 333 sessions in 2014-15 and up to 392 sessions in 2013-14)
  - Regression analyses showed that free-lunch eligible students had significantly less total active time in Edgenuity (94 fewer total active hours), as well as students classified as "well below target" in their fall math performance (59 fewer total active hours)
  - Alternatively, female students had 49 more total active hours, on average, in 2014-15

Table 3: Completed activities (per day) and average session duration by student subgroups using Edgenuity, 2014-15 and 2013-14				
	2014-15		2013-14	
Student subgroup	**Completed activities per day**	**Average session duration (min.)**	**Completed activities per day**	**Average session duration (min.)**
ELL	3.7	42.4	5.4	42
Not ELL	4.6	47.8	4.9	52.7
Special needs	3.8	45.4	3.9	48.8
None	4.7	48	5.2	52.8
Free lunch	4.4	46.8	4.9	51.6
Not eligible	5.1	51.5	5.3	56.4
Sig. below target	3.9	43.2	n.a.	n.a.
Not sig. below	4.5	47.7	n.a.	n.a.

Students absent more often had significantly lower rates of completing activities—they completed two fewer activities per day on average in 2014-15 for each additional percentage point of absences (and one less activity per day in 2013-14). They also had significantly shorter session durations and spent significantly more time idle while logged in.

Estimating the relationship of Edgenuity use to student achievement

- Propensity score and nearest neighbor matching and fixed effects models that adjust for student, grade and school differences were used to examine whether student use of Edgenuity improves their math and reading performance (as measured on the MAP tests, from fall to spring)
  - Two comparisons: Edgenuity users matched to all H.S. student non-users, and Edgenuity users matched to students in Edgenuity-using schools who are not users
- In both comparisons in 2014-15, we found no average effect of Edgenuity on students MAP test performance (math or reading) or MAP gains
  - Estimated effects ranged from 0.02 to -0.06 (in MAP scale scores), but none were statistically significant
  - Estimated effects were more negative when comparing Edgenuity users matched to non-users in Edgenuity-using schools and in the 2013-14 school year (ranging from -0.02 to -0.08)
- Further empirical work needs to be undertaken to improve the statistical comparisons before conclusions are drawn about the relationship of Edgenuity use to student achievement