



Empowering Educators

Supporting Student Progress in the Classroom with Digital Games



PART 1:

A National Survey Examining Teachers' Digital Game Use and Formative Assessment Practices



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INTRODUCTION

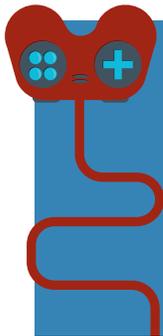
There is growing interest in the use of digital games as part of K-12 teachers' classroom instruction. For example, in Washington State, [legislation](#)¹ is being considered to create a pilot program for integrating games into the school curriculum. And in the fall of 2014, the White House and U.S. Department of Education hosted a [game jam](#)² to encourage and promote the development of learning games. As with all educational technologies, the most frequently asked question is, "Do they work?" The answer — and the question itself — is complex. Work for what purpose? To help students learn? Learn what? Core content knowledge or 21st century skills? Or is the purpose to engage students? In comparison to what? As with all educational technologies, the real answer to any of these questions is, "It depends." It depends on lots of factors, including the features of the game and, most importantly, what teachers do with those features as part of their instruction.

The A-GAMES project (Analyzing Games for Assessment in Math, ELA/Social Studies, and Science), a collaboration between the University of Michigan and New York University, studied how teachers actually use digital games in their teaching to support formative assessment. Formative assessment is a set of practices to gauge student progress toward learning goals, and to adjust instruction on the basis of that information to meet students where they are. Formative assessment is arguably one of the most important parts of a teacher's instructional tool kit. When used well, it has been found to be among the most powerful ways to improve student learning outcomes, and it may be particularly important to the success of low-ability students (Black & Wiliam, 1998). But as with any "best practice," in order to be effective, formative assessment approaches must be both useful and used. And that's where games — potentially — come into play.

This study was conducted in two parts: part one, which is detailed in this report, was a nationwide survey of K-12 teachers to investigate common formative assessment



practices, common game use practices, and the intersection of the two. Part two consisted of observations and interviews with 30 middle grades (5-8) teachers in the New York City area who volunteered to use one of eleven games as part of their teaching in Spring, 2014. These games were designed by a variety of learning games developers, and accessed by teachers in our study through [BrainPOP's GameUp portal](#).³ The survey offers a “mile high” picture of what teachers are doing with games related to formative assessment. The observations and interviews focused on how teachers used (or did not use) various features within each game that had the potential to be used for formative assessment. Hence, the case studies are organized around these formative assessment features, instead of individual teachers or games. The study is exploratory in nature, and is not intended to compare or gauge the effectiveness of games, game features, or approaches to formative assessment.



Our objective in A-GAMES is to illuminate how teachers understand and make use of game features that support formative assessment.

The field of games and learning is enjoying rapid growth in both research and development. Organizations such as the [Joan Ganz Cooney Center](#)⁴ and [Common Sense Media](#)⁵ conduct surveys to explore how teachers use and think about digital video games and related media. The [Games for Learning Institute](#)⁶, the [Learning Games Network](#)⁷, [The Games+Learning+Society Center](#)⁸ at the University of Wisconsin, [The New Mexico State University Learning Games Lab](#)⁹, [GameDesk](#)¹⁰, and [The Education Arcade](#)¹¹ at MIT conduct research on games and build games that embody their research. Researchers and developers at [UCLA/CRESST](#)¹² and [GlassLab](#)¹³ (in partnership with [SRI](#)¹⁴) are focused particularly on games and assessment.

The A-GAMES project occupies a special niche among these efforts. Our objective in A-GAMES is to illuminate how teachers understand and make use of game features that support formative assessment. Though prior surveys, including recent work from the [Joan Ganz Cooney Center](#)¹⁵ have explored how teachers use games for assessment, the A-GAMES survey is the first that we are aware of designed specifically to examine game use and formative assessment practices in relation to each other. The A-GAMES case studies look across a variety of educational games that are designed to be modest in scope, for use across one or several class periods, related to topics in various content areas. As noted in a 2013 review of the K-12 games market, “Short-form games provide tools for practice and focused concepts. They fit easily into the classroom time period and are especially attractive to schools as part of collections from which individual games can be selected as curricular needs arise” (Richards, Stebbins, & Mollering, 2013, p. 4), whereas longer-form games, such as GlassLab’s SimCityEDU, “have a stronger research base than short-form games and are focused on higher order thinking skills that align more naturally with new common core standards. These games do not fit as easily into the existing school day or classroom time period, but are the source of new experimentation in the research community and a variety of school contexts” (Richards, Stebbins, & Mollering, 2013, p. 4).

We hope the information in this study is useful to game designers as they refine and develop future educational games, to researchers as they frame further studies of games and learning, and also to educators and those who support educators as they think about the role of games in everyday classroom practice.

SUMMARY OF KEY SURVEY FINDINGS

If digital games are to play a key role in classroom instruction, they must support core instructional activities. Formative assessment — a set of techniques used by teachers to monitor, measure, and support student progress and learning during instruction — is a core practice of successful classrooms. **The A-GAMES project (Analyzing Games for Assessment in Math, ELA/Social Studies, and Science)** studied how teachers actually use digital games in their teaching to support formative assessment.

In Fall 2013, 488 K-12 teachers across the United States were surveyed about their digital game use and formative assessment practices to gain insight into their relationship to one another. The survey explored three areas:

- » **How teachers use digital games**
- » **How teachers conduct formative assessment**
- » **The relationship between a teacher’s digital game use and formative assessment practices**

Our results reveal that the way teachers use digital games for formative assessment is related to their overall formative assessment practices. Using digital games as part of instruction may enable teachers to conduct formative assessment more frequently and more effectively.



TEACHERS’ DIGITAL GAME USE

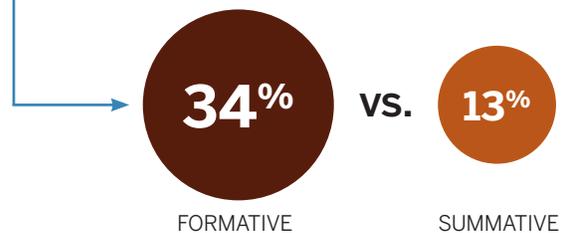
How often are games being used?

More than half of teachers use games weekly or more often in their teaching and the vast majority are at least moderately comfortable using games as a teaching tool. A teacher’s comfort level with using games for teaching is strongly related to how often they use digital games in their classroom (more comfortable = more often, less comfortable = less often).

What do teachers use digital games for?

The most frequent uses of games are to cover content mandated by state/national or local/district standards. In comparison, fewer teachers use games at least weekly to teach supplemental content.

While 34% of teachers use games at least weekly to conduct formative assessment, only 13% of teachers indicate a similar level of use for games as summative (end-of-unit or end-of-year) assessments.



Among teachers who use games at least monthly for teaching, the most frequent uses are to gauge student engagement with material, monitor student time-on-task, and to prepare students for mandated district/state tests.

What are barriers to using games?

The most frequently reported barriers — reported by more than 50% of teachers — are the cost of games, limited time in the curriculum, and lack of technology resources, such as computers and the Internet. Nearly half of teachers report they are unsure of where to find quality games and that it is hard to find games that fit their school’s curriculum. Forty percent of teachers indicate that an emphasis on standardized test scores in their school is a barrier to using games.

TEACHERS' FORMATIVE ASSESSMENT PRACTICES

When do teachers use formative assessment?

Most teachers report using formative assessment on a regular basis at the end of a lesson. The majority of teachers regularly use formative assessment during a lesson, both spontaneously and at planned checkpoints. Teachers use formative assessment less often at the start of a unit or lesson.

What are they assessing?

When assessing for formative purposes, teachers most often check for facts and knowledge, concepts and big ideas, and mastery of specific skills.

What techniques are they using?

The most frequently used formative assessment technique is observing students in class. At least once during each lesson, the majority of teachers look over students' shoulders, ask probing questions, and have students solve a problem during class.

How is assessment information used?

Teachers use information from formative assessment on a daily basis to convey/clarify lesson objectives, change the lesson in real-time, and give feedback to students. The overwhelming majority of teachers also use information from formative assessment to modify their instruction weekly or more often.

What are barriers to conducting formative assessment?

Almost one quarter of the teachers say they do not face any barriers to conducting formative assessment. Among those who did indicate barriers, the most frequently selected barriers were related to time. Teachers' reporting of barriers to formative assessment is consistent across subject areas, grade levels, and years of experience teaching. This suggests that these barriers are widespread.

THE RELATIONSHIP BETWEEN DIGITAL GAME USE AND FORMATIVE ASSESSMENT PRACTICES

Our survey results revealed significant differences in three areas that were related to teachers' frequency of using digital games for assessment:

1

Game use is related to how teachers conduct formative assessment.

Teachers who use digital games to make instructional decisions on a daily basis are more than twice as likely to check for motivation and engagement during formative assessment than teachers who rarely use games to make instructional decisions.

2

Game use is related to how teachers use formative assessment information.

Teachers who use digital games daily to document student progress are much more likely to use information from formative assessment on a daily basis to find or create alternative instructional strategies for a particular topic.

Teachers who use digital games for formative assessment more frequently are also more likely to use that information to track student progress and give students feedback on a daily basis. More than half of teachers who use digital games daily for formative assessment track student progress on a daily basis, compared to fewer than 25% of teachers who rarely use games for formative assessment. More than 90% of teachers who use digital games for formative assessment daily give feedback to their students on a daily basis using the information from that formative assessment.

3

Game use is related to the barriers teachers report to conducting formative assessment.

Teachers who use digital games more frequently for formative assessment are more likely to say they do not face any barriers to conducting formative assessment and less likely to say they lack training or preparation for making use of information from formative assessment. Teachers who use digital games weekly or more often to make instructional decisions are also less likely to report that they lack time to administer formative assessment or to name a lack of materials or resources provided by their curriculum for formative assessment as barriers to formative assessment.

Teachers who use digital games in particular ways related to assessment are also less likely to report facing a range of barriers to formative assessment. For example, teachers who use assessment systems built-in to digital games more frequently to assess student learning are less likely to report lack of time as a barrier to formative assessment.



ABOUT THIS SURVEY

In Fall 2013, we released a web-based survey to ask teachers about their use of digital games and their formative assessment practices. We received 488 responses from teachers across the United States.

The teachers who completed our survey were predominantly female (70.6% vs. 29% male), and taught in urban (28.2%), suburban (46.9%), and rural schools (24.9%). 82.7% taught in public schools, 4.5% in charter schools, and 12.8% in private or religious schools. Roughly half of the teachers responding were from schools with 50% or more students receiving free or reduced-price lunch. The teachers who responded had an average of 13.96 years of teaching experience, and the majority (63.9%) had 10 or more years of teaching experience. Fifty-six percent (55.9%) were subject-matter-only teachers, 30.9% were self-contained classroom teachers, who teach some or all subjects, and 13.1% were specialist teachers. Almost half of the teachers taught in grades 6 through 8.

This report shares results from the survey in the following three areas:

- » **How are teachers using digital games?**
- » **How are teachers conducting formative assessment?**
- » **What is the relationship between teachers' digital game use and formative assessment practices?**

Whenever we report a relationship, it was significant at a value of at least $p < .05$. More detailed information about our survey demographics and methodology is available in the appendix (See page 31).

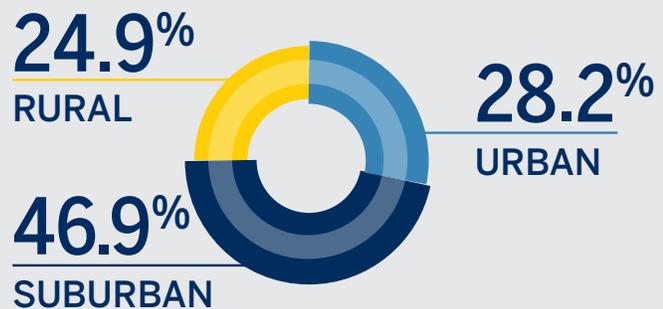
The Joan Ganz Cooney Center consulted with us on the design of the survey, and allowed us to use some of the same items included in their [survey on teachers and digital game use](#)¹⁵ (Takeuchi & Vaala, 2014).

TEACHER RESPONDENTS: BY THE NUMBERS

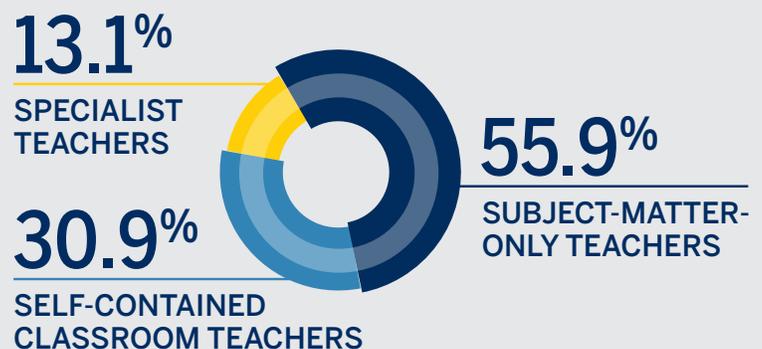
488 
RESPONDENTS FROM
ACROSS THE U.S.



AVERAGE
14 
YEARS OF EXPERIENCE



NEARLY HALF TAUGHT
GRADES
6-8 



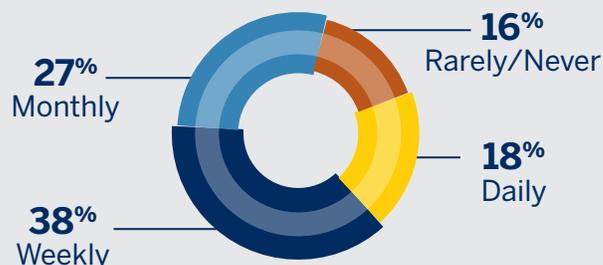
Note: In some instances, percentages may not total 100% due to rounding.

HOW ARE TEACHERS USING DIGITAL GAMES?

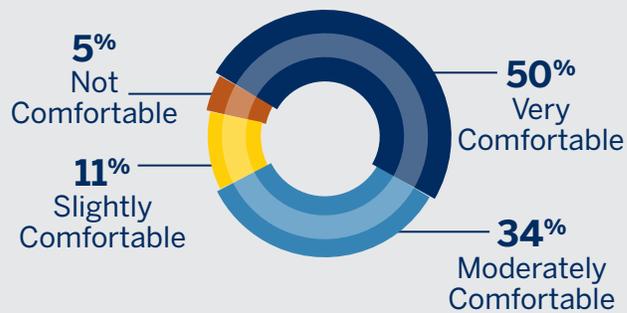
More than half of the teachers responding to our survey (57%) use games weekly or more often in their teaching, with 18% of teachers reporting that they use games for teaching on a daily basis. Overall, the vast majority of teachers (84%) surveyed are at least moderately comfortable using games as a teaching tool.

Comfort with using games for teaching is strongly related to how often teachers use digital games in their teaching. Almost 80% of teachers who are very comfortable using digital games in their teaching do so weekly or more often, while 100% of teachers who are not comfortable using games do so monthly or less often. But comfort is likely not the only factor keeping teachers from using games in the classroom, as over 50% of teachers who rarely use games in their teaching are at least moderately comfortable using games as a teaching tool.

How often do you use digital games for teaching?



How comfortable are you using digital games as a teaching tool?



Data from all survey respondents (n=450). Note: In some instances, percentages may not total 100% due to rounding.



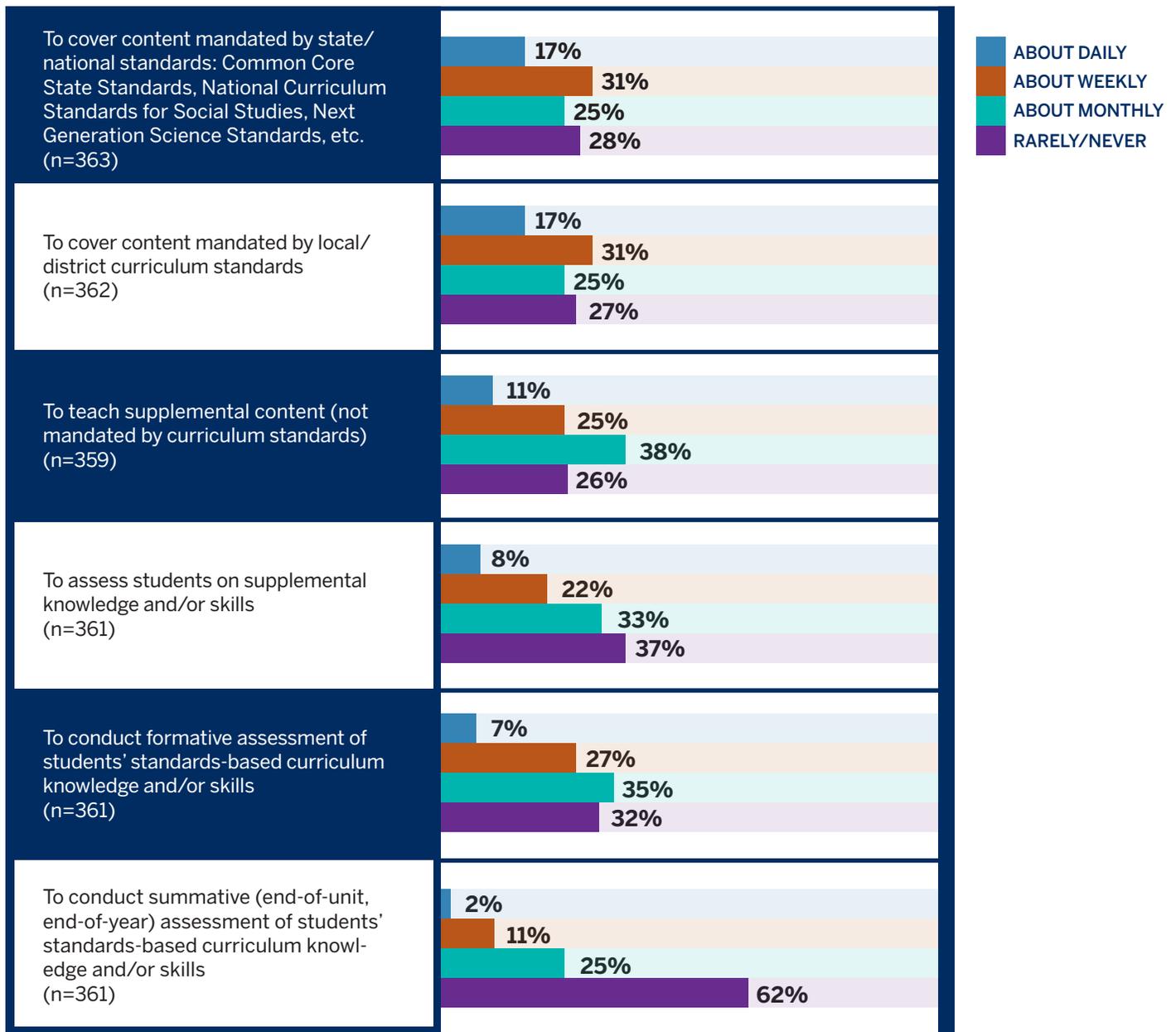
I use the games primarily to reinforce skills and provide high-engagement practice, particularly when students have been working on the same skill for a long time and are growing restless. I also use digital games as a reward.
—4th grade teacher

Digital games are being used for a variety of purposes. Teachers reported using games most often to cover both state/national and local/district standards, with 17% of teachers using digital games daily and 31% using digital games weekly to teach each type of standard. Teachers reported using digital games more frequently to teach

mandated or supplemental content than to assess students on either supplemental or curriculum knowledge. Looking specifically at teachers' use of digital games for formative assessment, 7% of teachers responded that they use digital games daily to conduct formative assessment, 27% weekly, and 35% monthly.

About how often do you use digital games for each of the following purposes?

Data from respondents who reported using digital games for teaching monthly or more often.

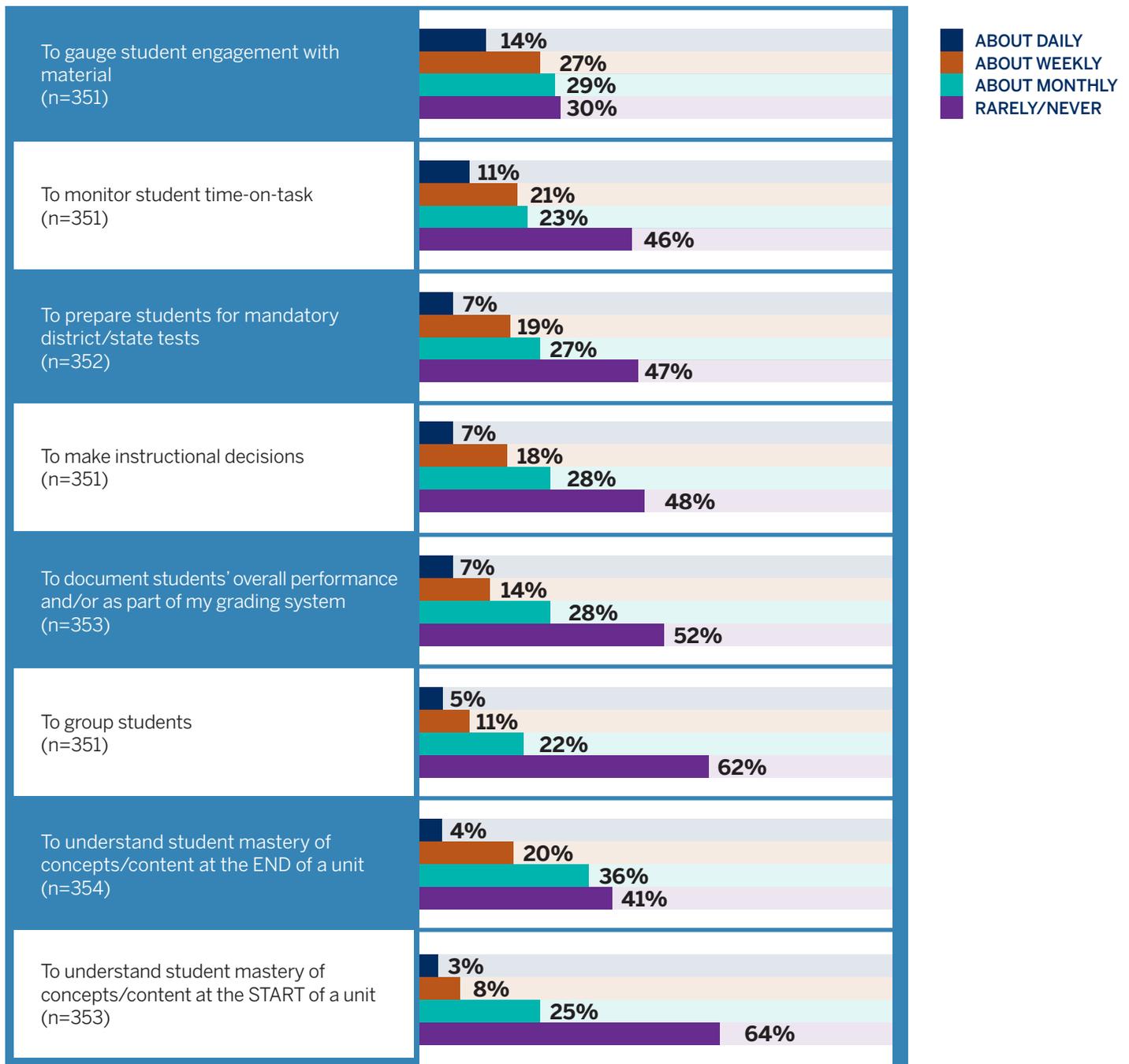


Over half of the teachers surveyed use digital games monthly or more often to gauge student engagement with material (70%), monitor student time-on-task (55%), prepare students for mandatory district/state tests (53%), make instructional decisions (53%), and understand student mastery of concepts/content at

the end of a unit (60%). However, few teachers use games for each of these purposes weekly or daily. On a daily basis, 14% of teachers use digital games to gauge student engagement with material and 11% use them to monitor student time-on-task.

How often do you use digital games for each purpose?

Data from respondents who reported using digital games for teaching monthly or more often.

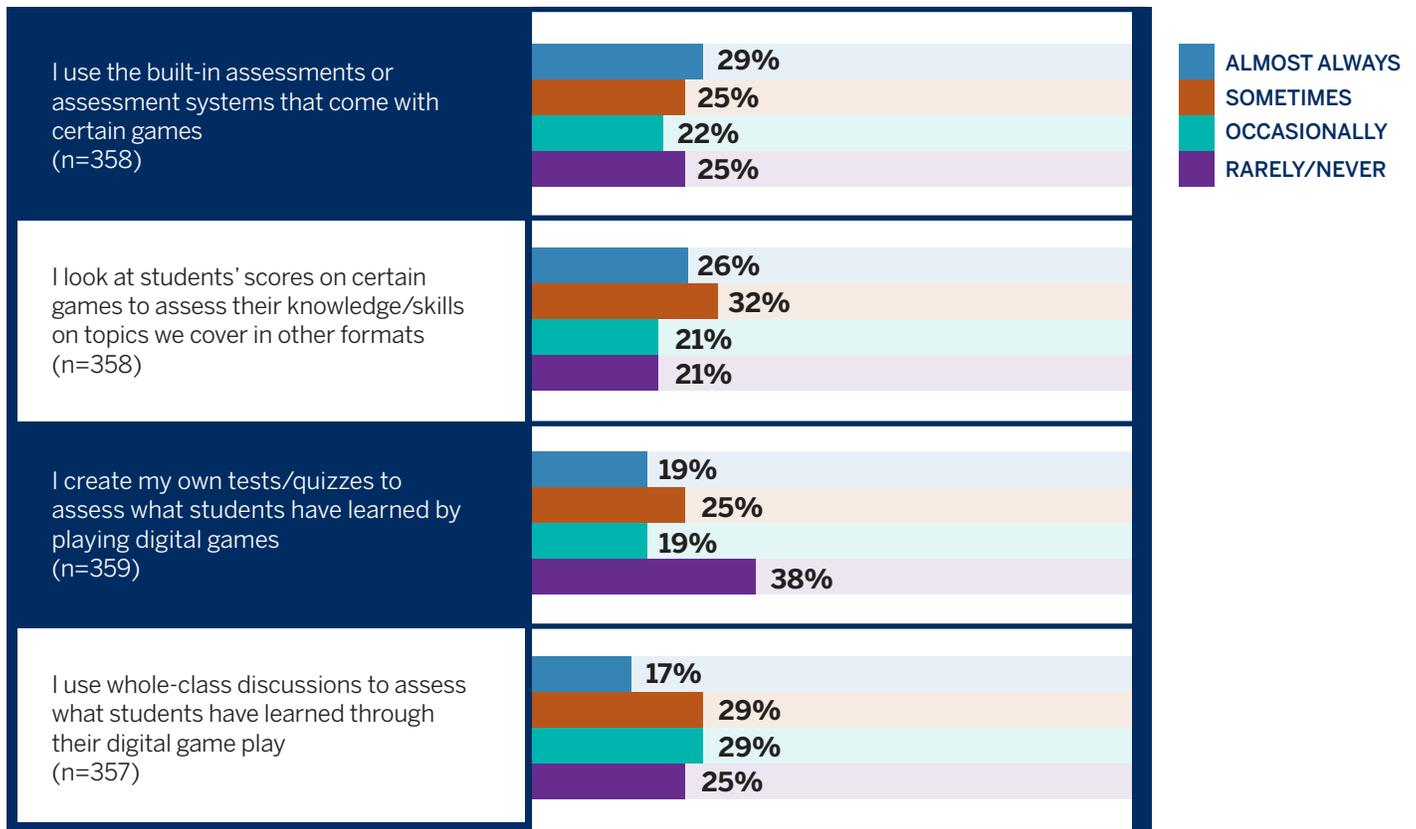


When teachers use digital games to assess student learning, they tend to use features within the game rather than classroom activities to do so. In particular, more than half of teachers who assess student learning with digital games regularly use built-in assessments (29% almost always, 25% sometimes) or students' game scores to assess knowledge covered outside of the game (26% almost always, 32% sometimes).

A substantial proportion of teachers also create their own assessments and use whole-class discussions to assess what students have learned during game play. Several teachers also assess student learning with games through writing, by asking students to respond to a critical thinking question related to content, or to reflect on challenges and successes during game play.

When you assess student learning with digital games, how often do you do each of the following?

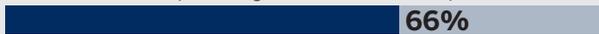
Data from respondents who reported using digital games for teaching monthly or more often.



OTHER INTERESTING FINDINGS*:

- » A higher percentage of elementary teachers use games weekly or more often for teaching and to cover content mandated by state/national standards: 66% of grade K-2 and 79% of grade 3-5 teachers use digital games weekly or more often for teaching, compared to 47% of grade 6-8 and 40% of grade 9-12 teachers.

K-2 teachers (weekly or more often)



Grade 3-5 teachers



Grade 6-8 teachers



Grade 9-12 teachers



Two-thirds of grade 3-5 teachers use digital games weekly or more often to cover content mandated by state/national standards, compared to 52% of grade K-2, 31% of grade 6-8, and 36% of grade 9-12 teachers. This is consistent with the larger market presence of games for younger learners (Richards, Stebbins, & Mollering 2013).

K-2 teachers (weekly or more often)



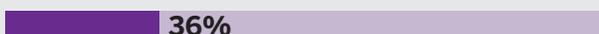
Grade 3-5 teachers



Grade 6-8 teachers

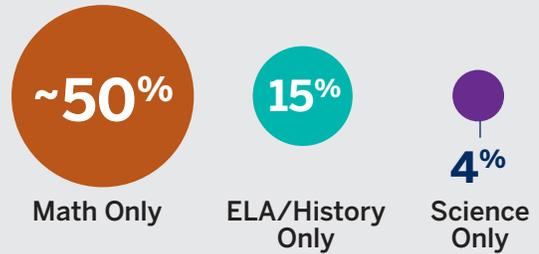


Grade 9-12 teachers



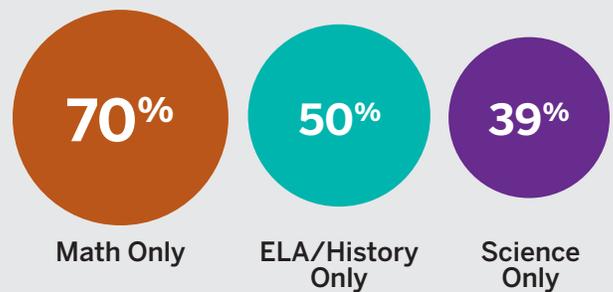
- » 42% of self-contained classroom teachers use digital games weekly or more often to carry out formative assessment, compared to 28% of subject-matter-only teachers. They also use built in assessments more frequently.

- » A higher percentage of math-only subject matter teachers, compared to ELA/history-only and science-only teachers, use digital games weekly or more often to cover content mandated by state/national standards. About half of math-only subject matter teachers use digital games weekly or more often to cover content mandated by state/national standards, compared to 15% of ELA/history-only and 4% of science-only teachers.



This is also true of overall digital game use and using games to prepare students for mandatory district/state tests. This also is likely due to supply issues regarding the numbers of games that are being produced in different content areas.

- » 70% of math-only subject matter teachers sometimes or always use students' scores to assess students on topics covered outside of the game, compared to 50% of ELA/history-only and 39% of science-only teachers.



- » The majority of teachers believe games are effective for motivating students (90%), helping students reinforce or master previously taught content (90%), providing useful information about student learning (66%), and teaching students new content (59%).

*Subject matter comparisons – only includes teachers who taught one of : math only, science only, ELA/History only. Self-contained vs. subject matter does not include specialist teachers.



BARRIERS TO USING DIGITAL GAMES IN TEACHING

Teachers in our survey reported a number of different kinds of barriers to using digital games in their teaching. The most frequently reported barriers are the cost of games, limited time in the curriculum, and lack of technology resources, such as computers and the Internet. Other areas of widespread concern are uncertainty about how to integrate games into instruction or where to find games that fit the needs of students or address specific content areas.

Years of teaching experience is only related to the two barriers about finding games. Teachers with more expe-

rience are less likely to name difficulty finding games or being unsure of where to find quality games as barriers to digital game use. Experience seems to help. Our data indicates that teachers with fewer years of experience are more likely to select “difficulty finding games that fit the curriculum” as a barrier, compared to teachers with more years of experience. This suggests that over time, teachers may have built up a repertoire of games, or are better able to find games that meet their needs in terms of quality and curricular alignment. However, the other barriers to game use appear to persist even after many years of classroom teaching experience.

What barriers do teachers face in using digital games in the classroom?

Data from all teacher respondents (n=434).
Teachers could select more than one option.



Cost of game software



Insufficient time in curriculum



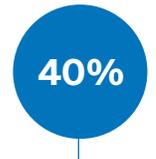
Lack of technology resources (computers, devices, Internet connection)



Not sure where to find quality games



Hard to find games that fit our school's curriculum



Emphasis on standardized test scores



Not sure how to integrate games into instruction



Unfamiliar with technology



Lack of administrative support



Lack of parental support



There are no barriers



HOW ARE TEACHERS CONDUCTING FORMATIVE ASSESSMENT?

In the survey, we provided teachers with the following definition of formative assessment:

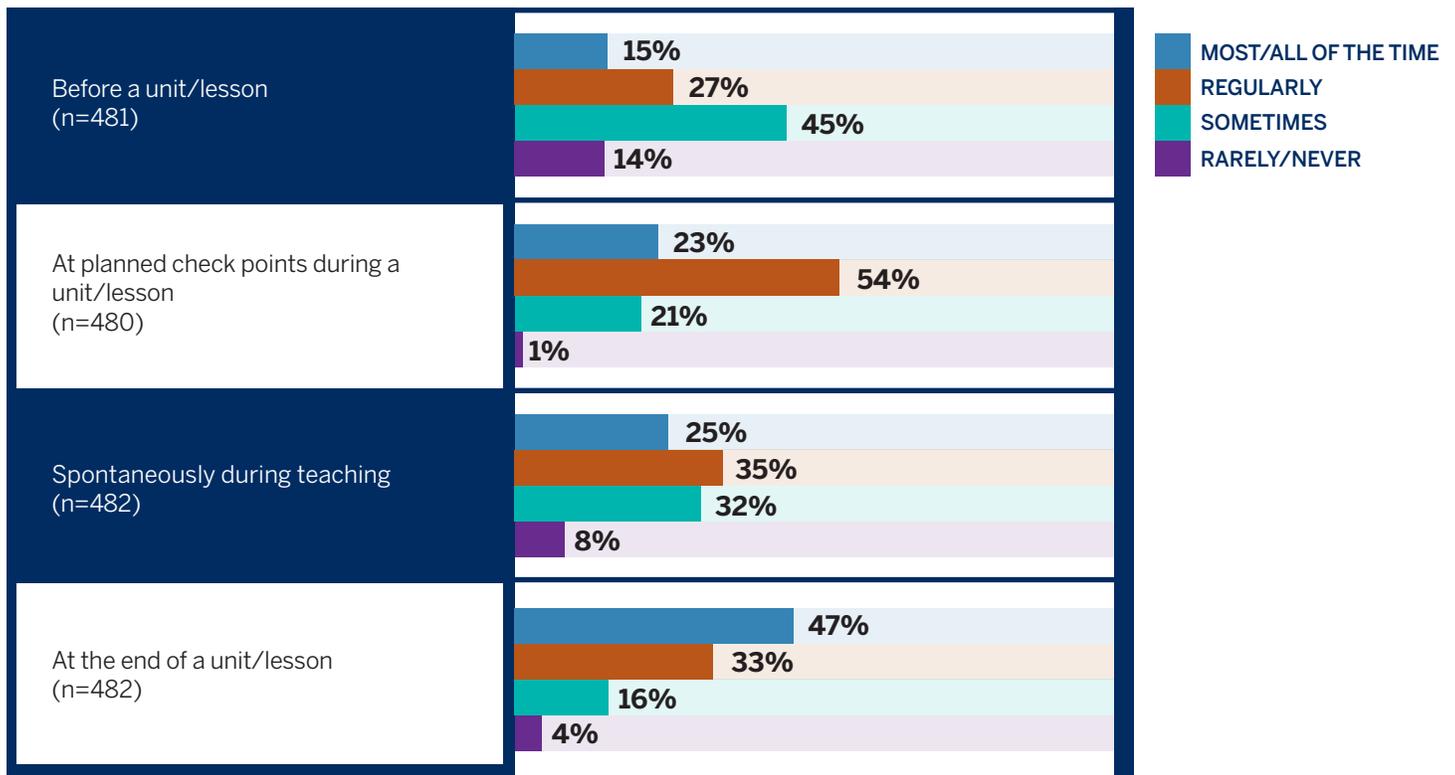
By “formative assessment” we mean the various ways that teachers check for student progress or understanding during instruction. The overall goal of formative assessment is to shape instruction or measure progress through instruction. This makes it different from summative assessment, which is used to measure student outcomes, often at the end of a unit.

We are interested in learning more about your formative assessment practices, and the ways you go about formative assessment during your lessons and units of instruction.

We asked teachers when they conduct formative assessment, the types of knowledge and skills they check for with formative assessment, the techniques they use, and how the information they obtain from formative assessment influences their teaching.

More teachers reported using formative assessment on a regular basis at the end of a lesson, with 47% of respondents reporting they do so most or all of the time and an additional 33% reporting that they do so regularly. The majority of teachers regularly use formative assessment during a lesson, both spontaneously and at planned checkpoints. Formative assessment is performed least frequently at the beginning of a lesson; only 15% of teachers use formative assessment before a lesson most or all of the time and an additional 27% do so regularly.

When do you use formative assessment?

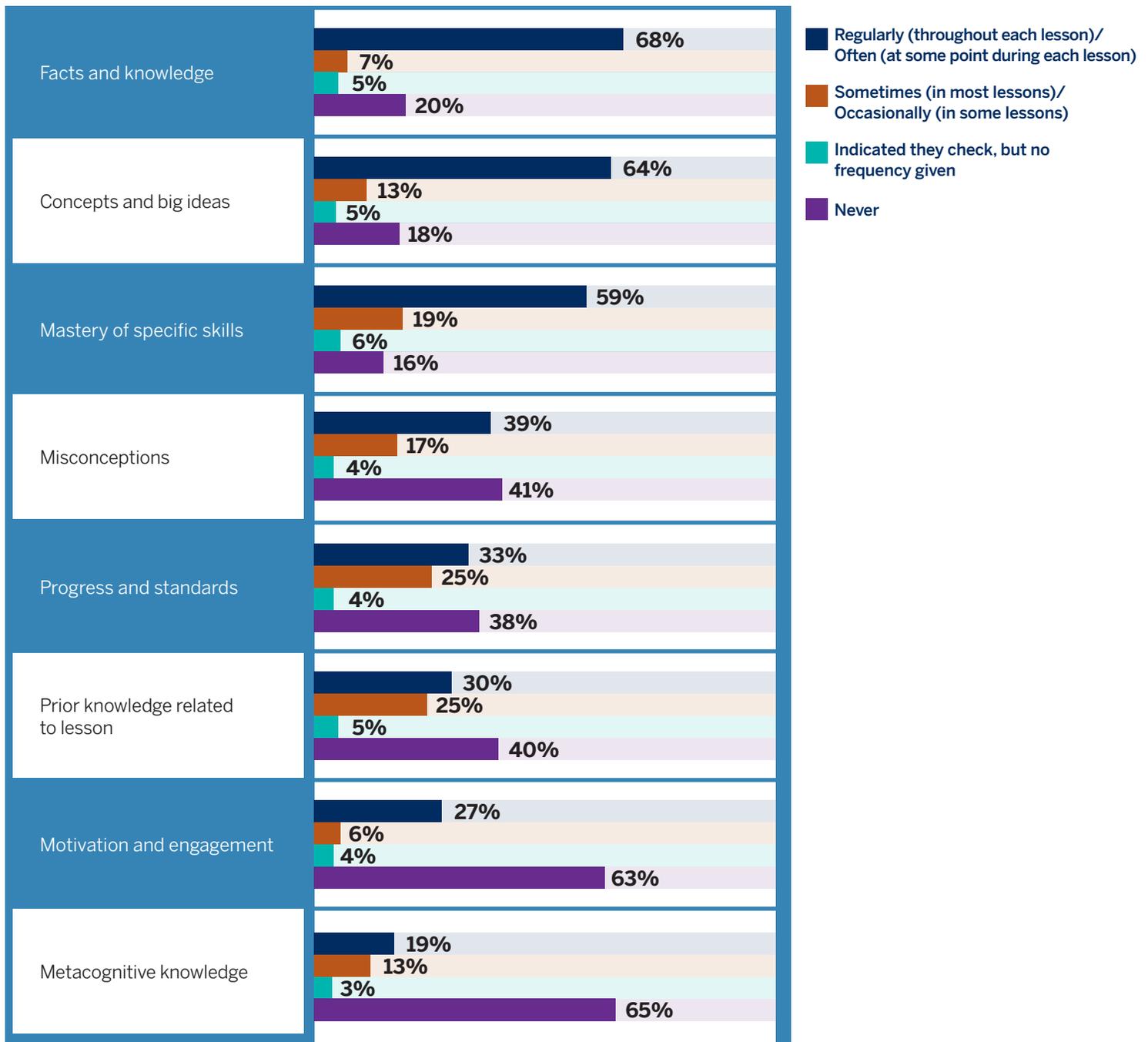


When assessing for formative purposes, teachers most often check for facts and knowledge (68% check at least once during each lesson), concepts and big ideas (64% check at least once during each lesson), and mastery of specific skills (59% check at least once during each lesson). Although prior knowledge and misconceptions

can greatly impact students' understanding, only about half of teachers consistently assess them. Only 27% of teachers check for motivation and engagement and 19% check for metacognitive knowledge during each lesson. The majority of the teachers surveyed never assess either metacognitive knowledge or motivation.

How often do you use formative assessment to check for different types of knowledge and skills?

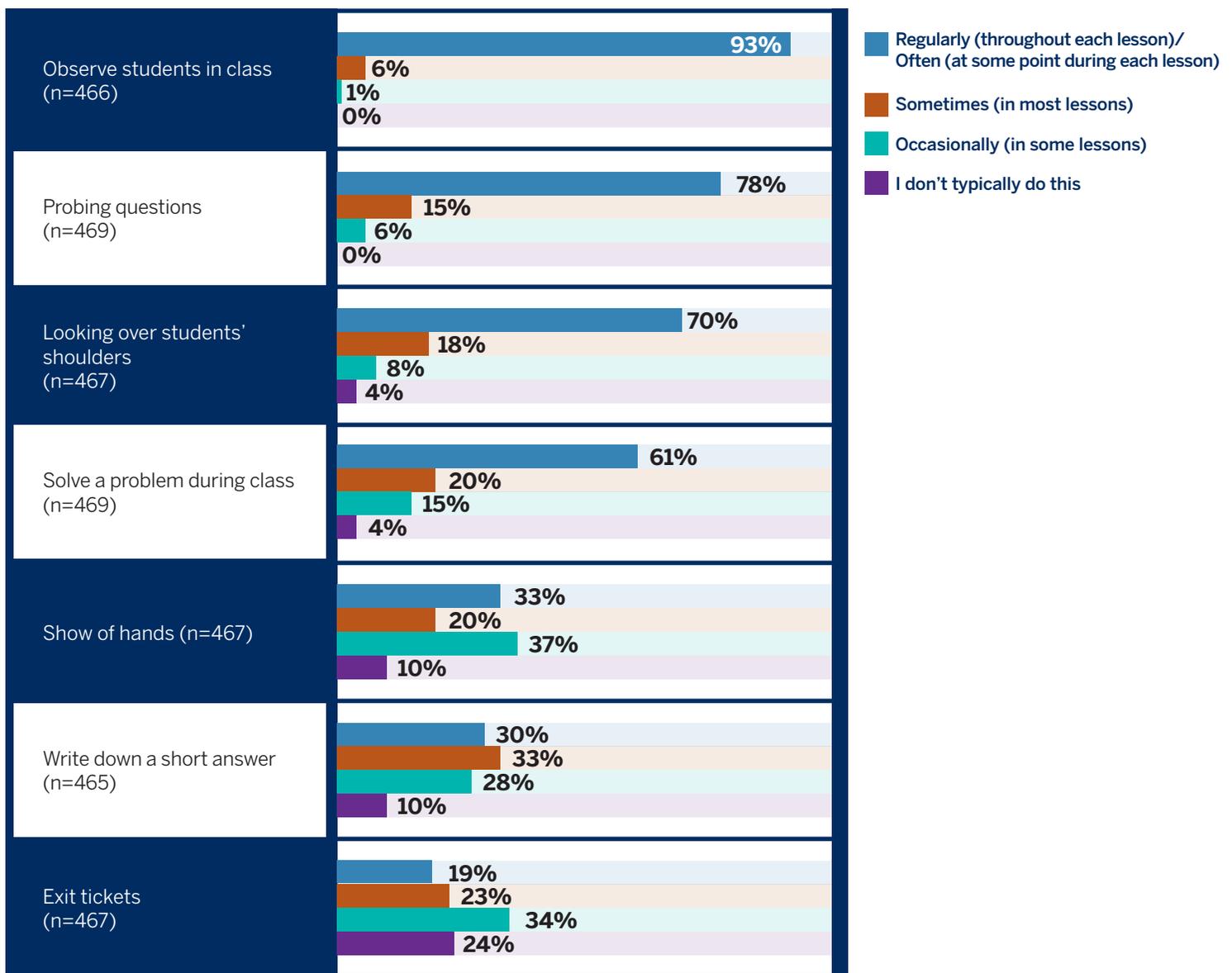
Data from all teacher respondents (n=487).



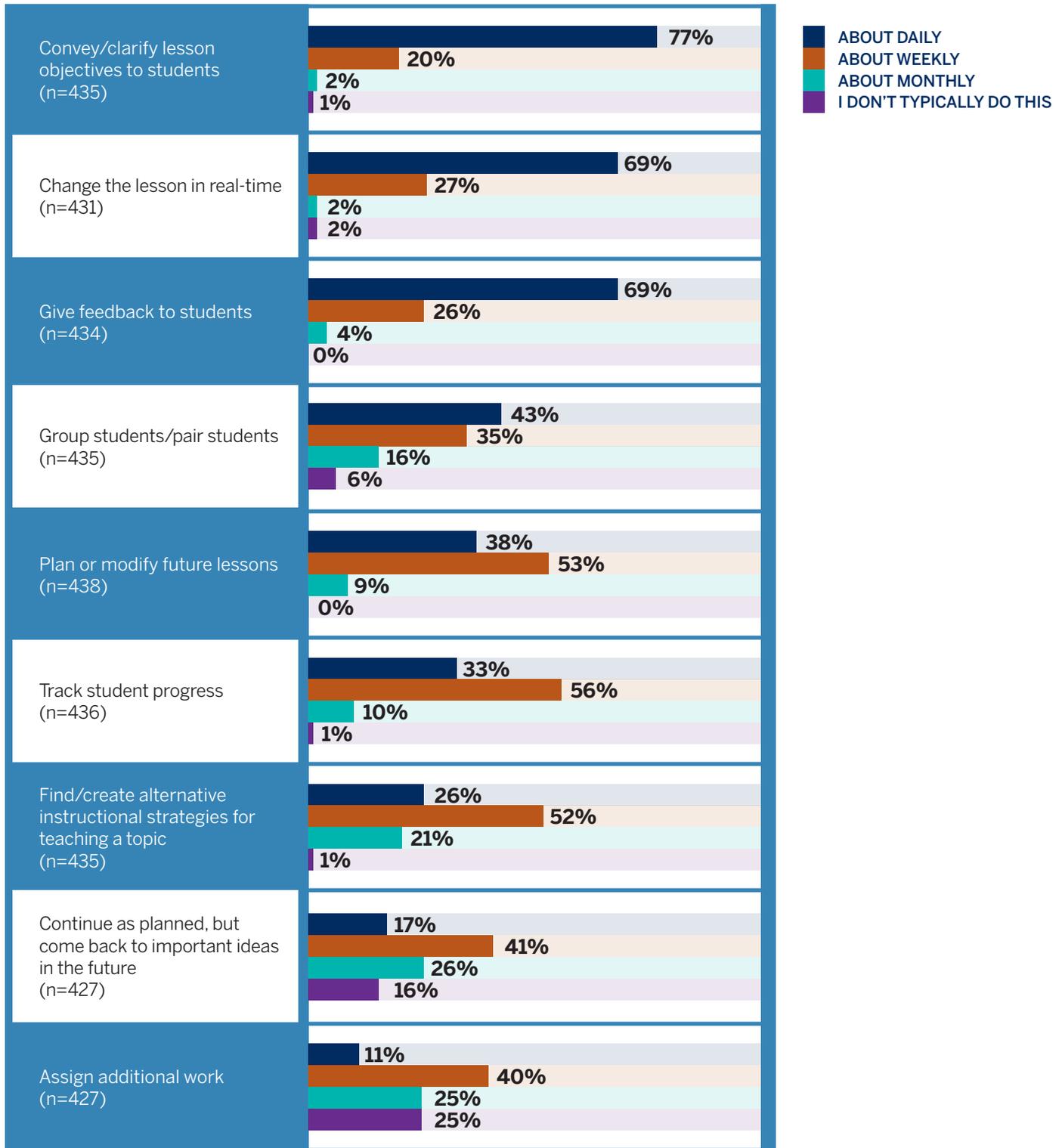
Teachers reported using a variety of techniques for conducting formative assessment. The most frequently used technique is observing students in class, which 78% of teachers do throughout each lesson. At least once during each lesson, the majority of teachers also look over students' shoulders (70%), ask probing questions (78%), and have students solve a problem during class

(61%). Observing students in class and looking over their shoulders do not require advanced preparation and can take place during regular instruction. Having students write down a short answer or complete an exit ticket, both of which require more class time than other formative assessment techniques, are used least frequently.

How often do you use each of these formative assessment techniques?



What do you do with the information from formative assessment?



In addition to gathering information about student learning, a key component of formative assessment is using this information to modify instruction. Instructional modification takes a variety of forms, including restating objectives for students, giving specific feedback to students, and changing the current lesson or future lessons. The majority of teachers use information from formative assessment on a daily basis to convey/clarify lesson objectives to students (77%), change the lesson

in real-time (69%), and give feedback to students (69%). The overwhelming majority of teachers use information from formative assessment to modify their instruction weekly or more often. Among the actions teachers reported taking in response to formative assessment information, the least frequent was assigning additional work to students, however 51% of teachers do this at least weekly.

OTHER INTERESTING FINDINGS:

- » Teachers frequently discuss information from formative assessment with teaching colleagues.
- » Subject area is related to how teachers conduct formative assessment. Math-only subject teachers more often ask students to solve problems for formative assessment and more often check for procedures and processes and misconceptions. ELA/History-only subject teachers more often check for concepts and big ideas and use probing questions for formative assessment. They are also more likely to use information from formative assessment to create alternative instructional strategies for teaching a topic on a daily basis.
- » Of all of the formative assessment techniques, looking over students' shoulders for formative assessment is the only one that appears to be related to years of teaching experience. Teachers with fewer years of experience are more likely to look over students' shoulders "often" or "regularly" as a formative assessment practice than more experienced teachers.
- » Teaching experience is also related to a teacher using information from formative assessment to give feedback to students. Teachers with fewer years of experience are less likely to use information from formative assessment to give students feedback on a daily basis than teachers with more years of experience.

- » 26% of self-contained classroom teachers often or regularly check for metacognitive knowledge, compared to 15% of subject matter teachers.
- » The percentage of teachers who ask for a show of hands as a formative assessment technique decreases as grade level increases:

K-2 teachers (often or regularly)



Grade 3-5 teachers



Grade 6-8 teachers

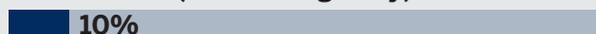


Grade 9-12 teachers



- » Teachers in grades 3-5 and 6-8 use exit tickets more often than other teachers:

K-2 teachers (often or regularly)



Grade 3-5 teachers



Grade 6-8 teachers



Grade 9-12 teachers



Subject matter comparisons – only includes teachers who taught one of: math only, science only, ELA/History only. Self-contained vs. subject matter does not include specialist teachers. Gradeband comparisons excluded teachers who taught in multiple gradebands.

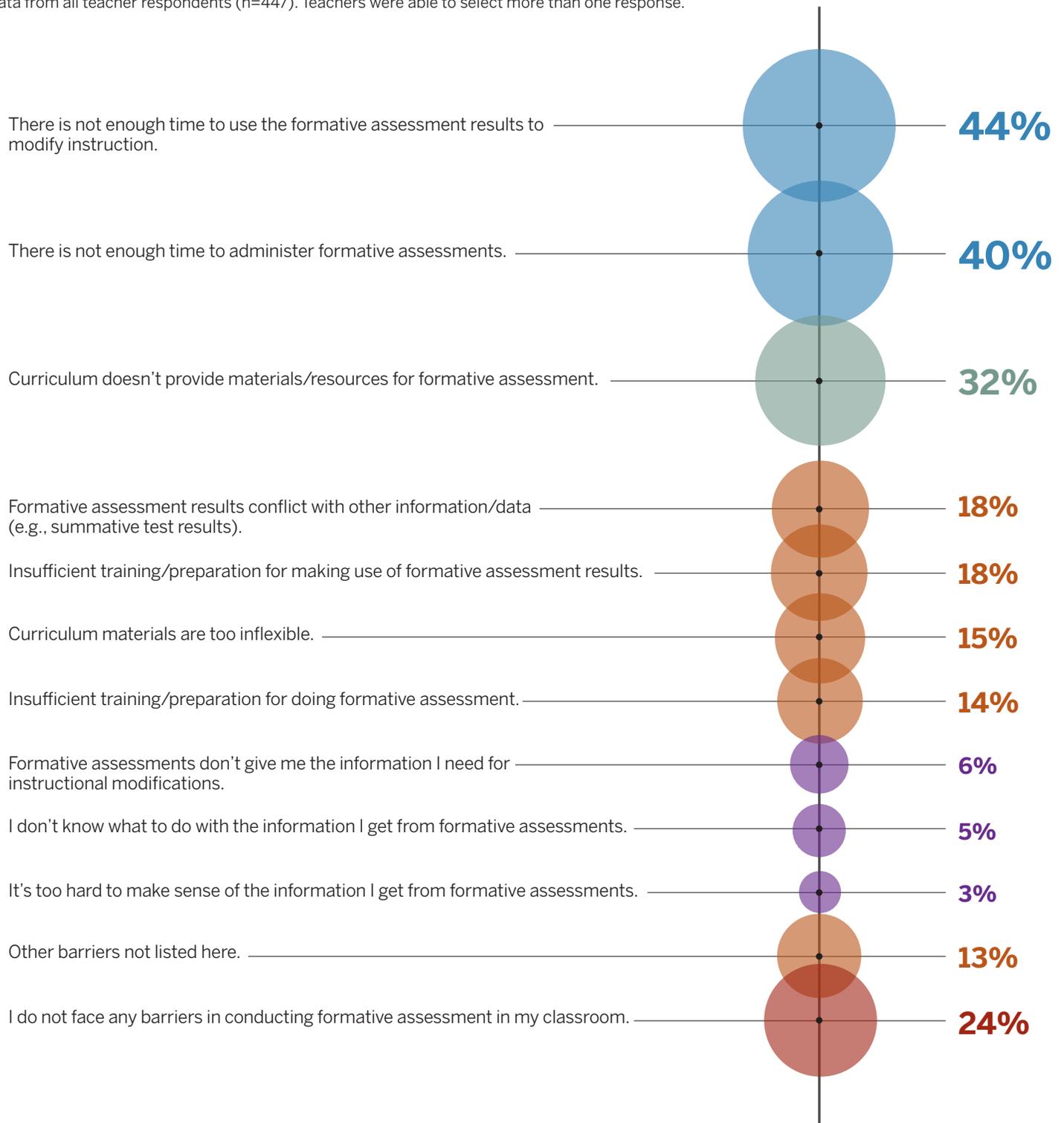
BARRIERS TO CONDUCTING FORMATIVE ASSESSMENT

We also asked teachers about the barriers they face in conducting formative assessment. Almost one quarter of the teachers we surveyed said they do not face any barriers to conducting formative assessment. Among those who did indicate barriers, the most frequently selected barriers are those related to time, with 59% of teachers selecting at least one of the time barriers.

Barriers to formative assessment were consistently reported across classroom type, grade, and subject area, suggesting that these barriers are widespread. Teachers with more years of teaching experience are less likely to view insufficient training or preparation for doing formative assessment as a barrier to formative assessment and are more likely to select that they do not face any barriers to conducting formative assessment. Surprisingly, teaching experience is not significantly related to any of the other barriers, suggesting that barriers to formative assessment do not go away with experience.

What barriers do you face in conducting formative assessment?

Data from all teacher respondents (n=447). Teachers were able to select more than one response.



WHAT IS THE RELATIONSHIP BETWEEN TEACHERS' DIGITAL GAME USE AND FORMATIVE ASSESSMENT PRACTICES?

Our main objective in this work was to examine the relationship between teachers' game use and formative assessment practices. The survey results revealed significant differences in three areas that were related to teachers' frequency of using digital games for assessment:

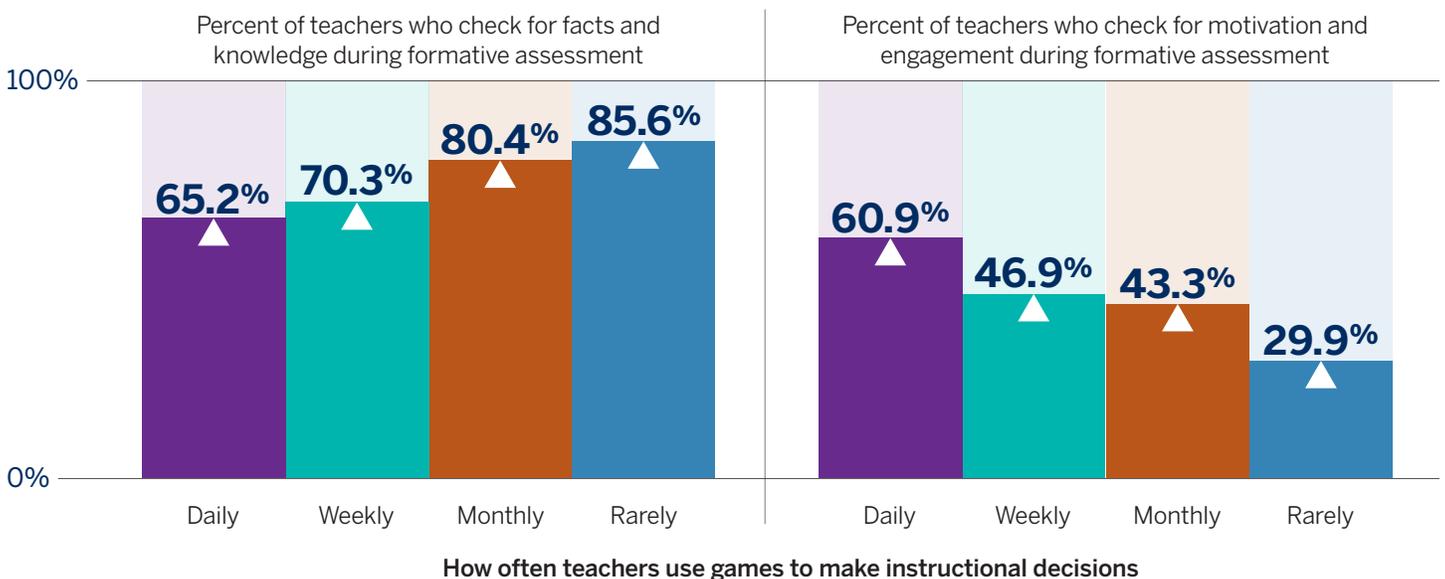
1. How teachers conduct formative assessment
2. How teachers use formative assessment information
3. The barriers they report in conducting formative assessment

Teachers who use digital games to make instructional decisions more frequently are also more likely to check for motivation and engagement, and less likely to check for facts and knowledge when conducting formative assessment.

A teacher who uses digital games to make instructional decisions on a daily basis is more than twice as likely to check for motivation and engagement during formative assessment than a teacher who rarely uses games to make instructional decisions.

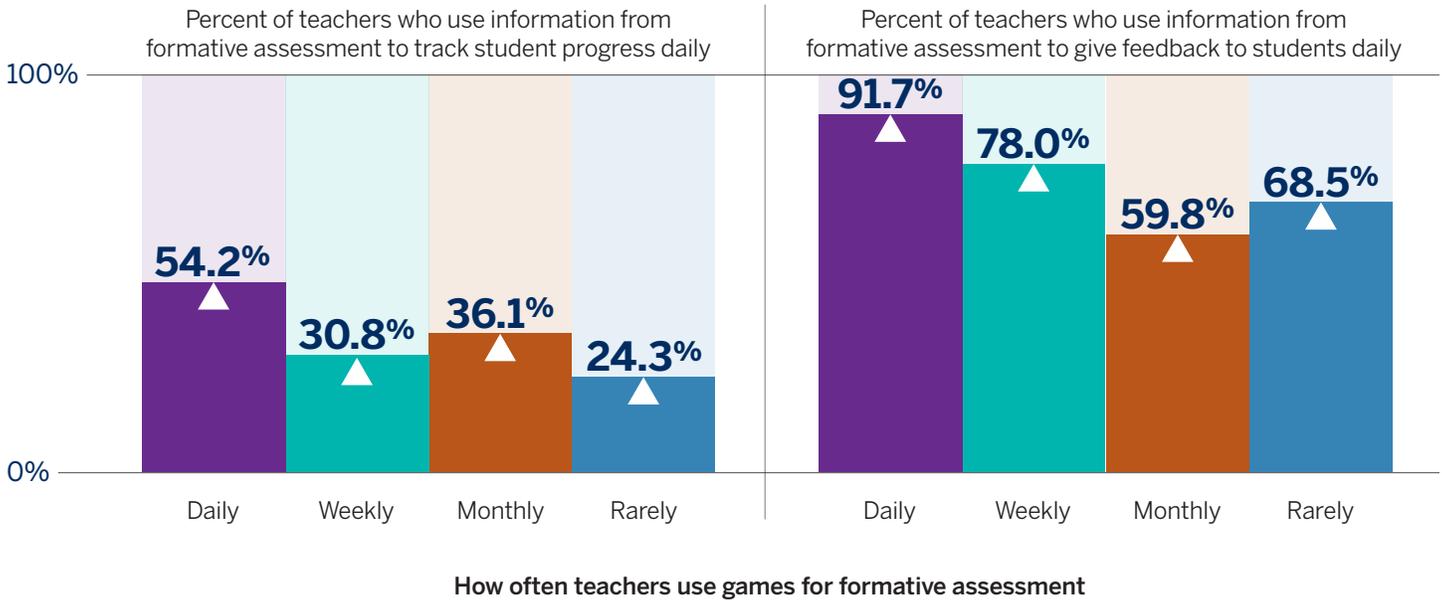
Teachers' formative assessment practices by their frequency using digital games to make instructional decisions.

Data from respondents who reported using digital games for teaching monthly or more often [Rarely (n=167), Monthly (n=97), Weekly (n=64), Daily (n=23)].



Teachers’ formative assessment practices by their frequency using digital games for formative assessment.

Data from respondents who reported using digital games for teaching monthly or more often [Track student progress: Rarely (n=111), Monthly (n=119), Weekly (n=91), Daily (n=24); Give feedback to students: Rarely (n=111), Monthly (n=117), Weekly (n=91), Daily (n=24)].



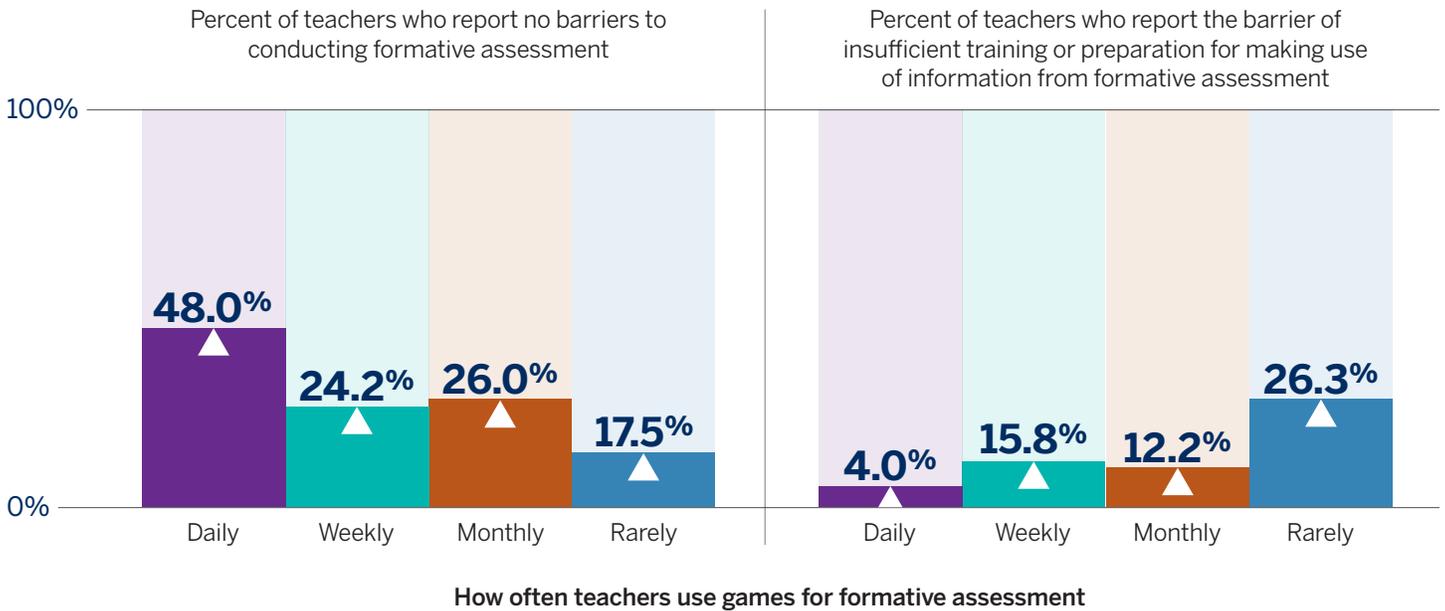
Teachers who more frequently use digital games for formative assessment are more likely to use information from formative assessment to track student progress and give students feedback on a daily basis. Slightly more than 54% of teachers who use digital games daily for formative assessment use information from formative assessment to track student progress daily, compared to only 24.3% of teachers who rarely use games for formative assessment. Similarly, 91.7% of teachers who use digital games for formative assessment daily give feedback to students on a daily basis using information from formative assessment.

Our survey results suggest a relationship between using digital games and a reduction of barriers to conducting formative assessment. Teachers who use digital games for formative assessment more frequently are more likely to say they do not face any barriers in conducting formative assessment and less likely to say they lack training or preparation for making use of information from formative assessment.

For example, while 17.5% of teachers who rarely or never use games for formative assessment say they do not face any barriers to conducting formative assessment, 48% of teachers who use games daily for formative assessment report that they do not face any barriers to conducting formative assessment. Teachers who use digital games weekly or more often to make instructional decisions are more likely to say they do not face any barriers to conducting formative assessment. They are also less likely to report facing several particular barriers to formative assessment. For example, 44.3% of teachers who use digital game to make instructional decisions monthly or less often report that they face the barrier of lack of time to administer formative assessment, compared to 22.1% of teachers who use digital games to make instructional decisions weekly or more often.

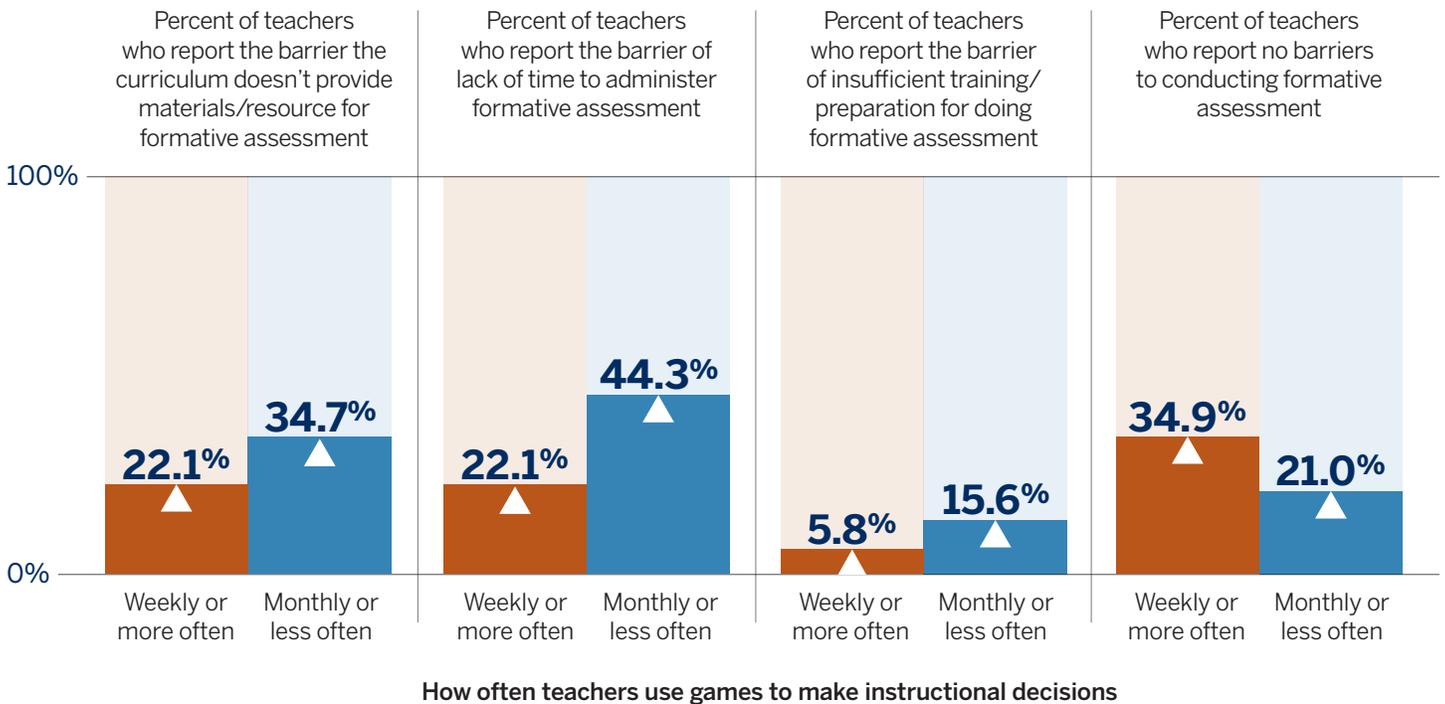
Barriers teachers face in conducting formative assessment by their frequency of using digital games for formative assessment.

Data from respondents who reported using digital games for teaching monthly or more often [Rarely (n=114), Monthly (n=123), Weekly (n=95), Daily (n=25)].



Barriers teachers face in conducting formative assessment by their frequency of using digital games to make instructional decisions.

Data from respondents who reported using digital games for teaching monthly or more often [Monthly or more often (n=262), Weekly or more often (n=86)].



OTHER INTERESTING FINDINGS:

Teachers' particular formative assessment practices with digital games appear to be related to their overall formative assessment practices, suggesting that rather than changing how teachers assess students, games might enable teachers to conduct formative assessment more frequently and more effectively.

For example, teachers who use student scores more frequently to assess student learning with digital games are also more likely to check for procedures and processes during formative assessment and more likely to have students solve a problem as formative assessment during each lesson. In contrast, teachers who more frequently create their own assessments to assess student learning with digital games are more likely to check for metacognitive knowledge during formative assessment.

Finally, teachers who more frequently use whole-class discussions to assess student learning with digital games are more likely to use probing questions to conduct formative assessment. In several cases, teachers' digital game assessment practices were also related to how they use information from formative assessment.

Those who use digital games daily to document student progress are much more likely to use information from formative assessment on a daily basis to find or create alternative instructional strategies for a particular topic. Teachers who use digital games in particular ways related to assessment were also less likely to report facing a range of barriers to formative assessment.

For example, teachers who use built in assessment systems more frequently to assess student learning with digital games are less likely to report that lack of time for conducting formative assessment is a barrier to formative assessment.



TEACHER PROFILES



Trying to understand the implications of our survey data across many different issues and many different types of teachers is a complex endeavor. We therefore used *cluster analysis* to better identify how various teacher practices around games and formative

assessment are related. The clusters were built based on teachers' reported game use practices and their perceived effectiveness. We were able to identify four distinct "teacher profiles" from this data. These four types of teachers differ in terms of how often they use digital games for different purposes, and how effective they believe games are for different purposes.

There were no significant differences in cluster membership by classroom type, subject area, gender, years of teaching experience, age, or grade band.

TEACHER #1

The enthusiastic game-using teacher.

GAME-USE FREQUENCY AND PURPOSE

Teachers in this cluster use games more often than teachers in other clusters for understanding student learning and making instructional decisions, and use games more frequently than the average teacher in our study for all of the purposes identified in our survey.

PERCEPTION OF GAMES

These teachers are the most likely to believe games are effective for a variety of purposes.

FORMATIVE ASSESSMENT PRACTICES

These teachers are the most likely to use formative assessment before a lesson on a regular basis, and also the most likely (together with teachers in cluster 2) to check for motivation and engagement during formative assessment. Teachers in this cluster are almost twice as likely as teachers in cluster 4 to say they do not face any barriers to formative assessment.



77 (18%) of the teachers who responded to our survey fell into this cluster.

TEACHER #2

The frequent (but not for core content) game-using teacher.

GAME-USE FREQUENCY AND PURPOSE

Teachers in this cluster use games more frequently than teachers in other clusters for supplemental content and gauging student engagement. They are less likely to use games for assessment or to cover mandatory content than the average teacher in our study.

PERCEPTION OF GAMES

These teachers believe games are effective for a variety of purposes, but slightly less so than teachers in cluster 1.

FORMATIVE ASSESSMENT PRACTICES

These teachers are most likely to check for motivation and engagement during formative assessment and most likely to use information from formative assessment to give students feedback on a daily basis.



72 (17%) of the teachers who responded to our survey fell into this cluster.

TEACHER #3

The frequent, but not so enthusiastic game user.

GAME-USE FREQUENCY AND PURPOSE

Teachers in this cluster use games more frequently than teachers in other clusters to cover mandatory content. However, they use games less often than the average teacher in our study for assessing students and for supplemental content.

PERCEPTION OF GAMES

These teachers do think that games are more effective than the average teacher in our study, but not to the extent of teachers in clusters 1 or 2.

FORMATIVE ASSESSMENT PRACTICES

Teachers in this cluster are less likely to check for motivation and engagement during formative assessment and less likely to report that they do not face any barriers to formative assessment than teachers in clusters 1 and 2.



136 (32%) of the teachers who responded to our survey fell into this cluster.

TEACHER #4

The not-so-into games teacher.

GAME-USE FREQUENCY AND PURPOSE

Teachers in this cluster use games less often, on average, than teachers in the other three clusters, for any of the purposes we asked about. They are less than half as likely to use digital games on a weekly basis than teachers in other groups, and at least three times less likely to be very comfortable using digital games than teachers in other groups.

PERCEPTION OF GAMES

These teachers are least likely to think games are effective for any purpose, especially for teaching new content to students or providing useful information about student learning.

FORMATIVE ASSESSMENT PRACTICES

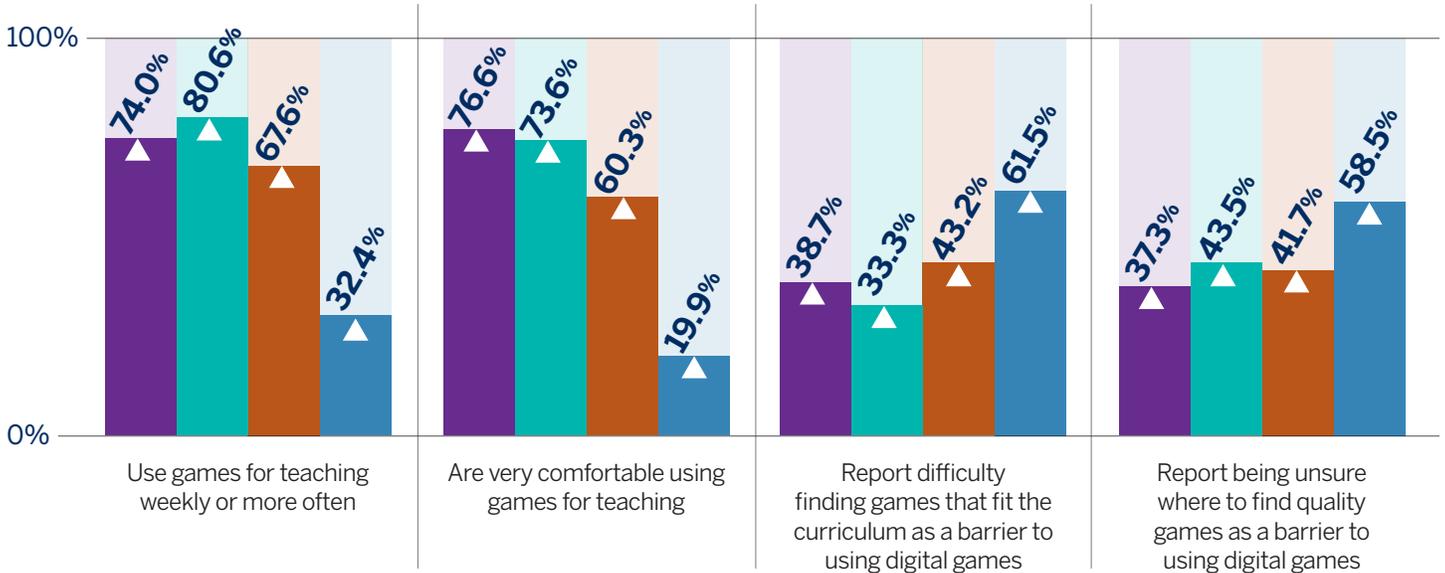
These teachers are less likely than teachers in any of the other clusters to check for motivation and engagement during formative assessment, or to use information from formative assessment to give feedback to students on a daily basis. They are also least likely to report that they do not face any barriers to formative assessment.



136 (32%) of the teachers who responded to our survey fell into this cluster.

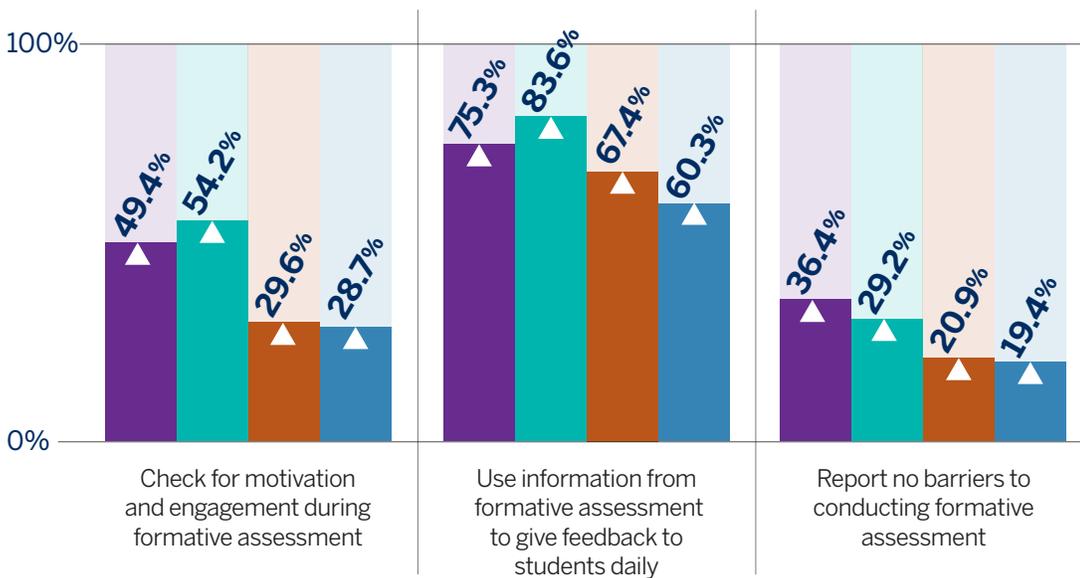
Teachers’ game use and barriers by teacher profile cluster group.

Data from all teacher respondents [Games for teaching/ Very comfortable using games: Cluster 1 (n=77), Cluster 2 (n=72), Cluster 3 (n=136), Cluster 4 (n=136); Barriers: Cluster 1 (n=75), Cluster 2 (n=69), Cluster 3 (n=132), Cluster 4 (n=135)].



Teachers’ formative assessment practices and barriers by teacher profile cluster group.

Data from all teacher respondents [Motivation and engagement: Cluster 1 (n=77), Cluster 2 (n=72), Cluster 3 (n=135), Cluster 4 (n=136); Feedback to students: Cluster 1 (n=73), Cluster 2 (n=67), Cluster 3 (n=132), Cluster 4 (n=131); Do not face any barriers: Cluster 1 (n=77), Cluster 2 (n=72), Cluster 3 (n=134), Cluster 4 (n=134)].



APPENDIX

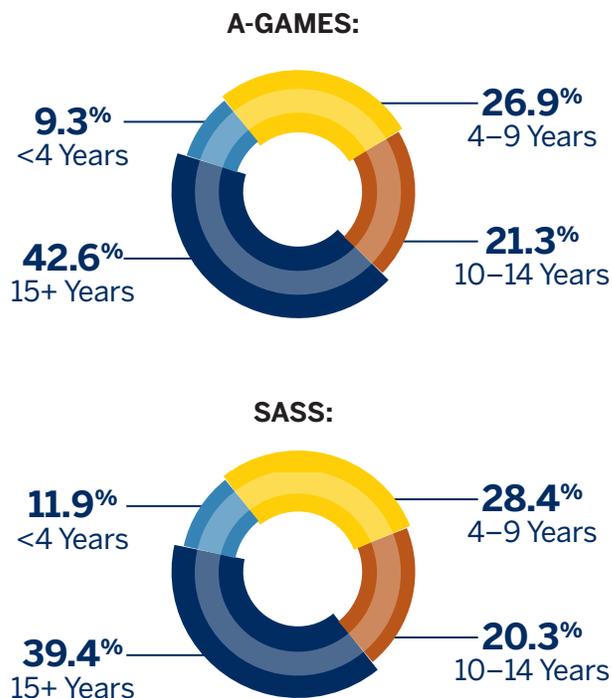
METHODS AND DEMOGRAPHICS

In Fall 2013, we fielded a 20-minute web-based survey with items about formative assessment practice, video game practice, and teacher/school demographics. Teachers were recruited to complete the survey through postings on social media and on popular education and technology web sites. The survey yielded 488 valid responses from teachers in the United States. We compared our population of teachers to the national population of teachers using data from the [NCES Schools and Staffing Survey \(SASS\)](#).¹⁶ Our respondents were compared based on gender, age, years of teaching experience, school type, and the percent of students who receive free or reduced price lunch. Gender was the only category in which our respondents were significantly different (at the $p < 0.05$ level) from the national population of K-12 teachers. While nationally, 23.9% of teachers are male, 29% of our survey respondents were male. Given these demographic similarities, we feel our population of teachers is similar to teachers nationwide along demographic dimensions. However, it is important to keep in mind that our teacher respondents may not be representative along other dimensions. For example, given our recruitment methods, it is possible that the proportion of teachers in our survey who use games may exceed the game using proportion of the national population of teachers.

The survey response population included teachers from urban schools (28.2%), suburban schools (46.9%), and rural schools (24.9%). Nearly 83% were in public schools, 4.5% in charter schools, and 12.8% in private or religious schools. Nearly 46% of the teachers responding were from schools with 50% of more students receiving free or reduced price lunch. Our respondents had taught for an average of 13.96 years, and the majority (63.8%) have 10 or more years of teaching experience. Nearly 56% of our respondents are subject matter only teachers, 30.9% are self contained classroom teachers, who teach some or all subjects, and 13.1% are specialist teachers. Almost half of our teachers teach at least one of grades 6 through 8.

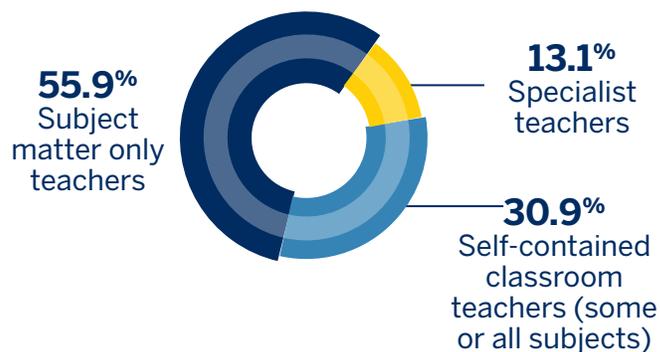
Years of teaching experience—

Data from all teacher respondents (n=484).



What type of teacher are you?

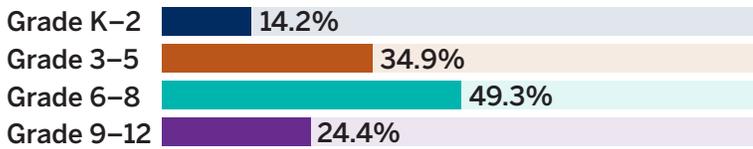
Data from all teacher respondents (n=487).



In some instances percentages may not total 100% due to rounding.

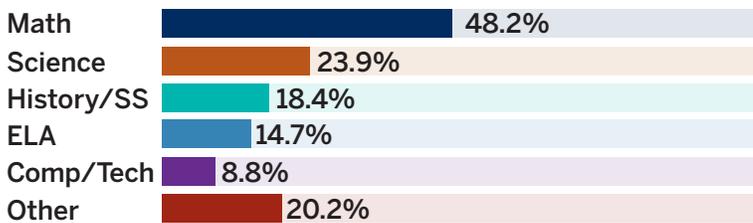
What grades do you teach?

Data from all teacher respondents (n=487). Note: Respondents were asked to select all grades they teach.



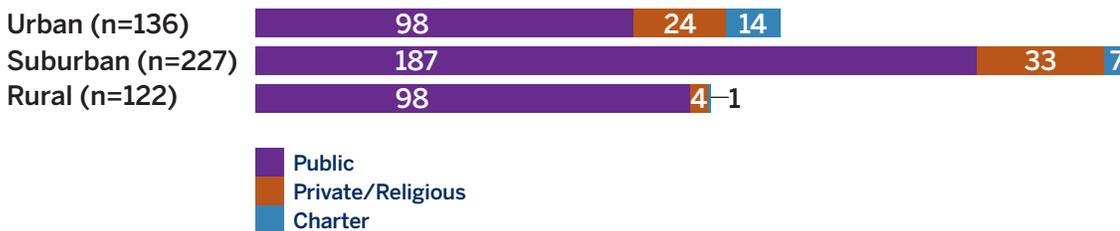
What subjects do you teach?

Data from all subject-area teachers (n=272). Note: Respondents were asked to select all subjects they teach.



What type of school do you teach in and where is it located?

Data from all teacher respondents (n=484).



RESEARCH TEAM

Barry Fishman, Ph.D. is Professor of Learning Technologies in the University of Michigan School of Information and School of Education. His research focuses on: teacher learning and the role of technology in supporting teacher learning, video games as models for learning environments, and the development of usable, scalable, and sustainable learning innovations through design-based implementation research (DBIR). He was co-author of the Obama Administration's 2010 U.S. National Educational Technology Plan, served as Associate Editor of *The Journal of the Learning Sciences* from 2005-2012, and was the 2001 recipient of the Jan Hawkins Award for Early Career Contributions to Humanistic Research and Scholarship in Learning Technologies. He received his A.B. from Brown University in English and American Literature in 1989, his M.S. from Indiana University in Instructional Systems Technology in 1992, and his Ph.D. in Learning Sciences from Northwestern University in 1996.

Jan L. Plass, Ph.D. is the Paulette Goddard Professor of Digital Media and Learning Sciences at NYU Steinhardt and founding director of CREATE. Dr. Plass is also the co-director of the Games for Learning Institute. His research is at the intersection of cognitive science, learning sciences, and design, and seeks to enhance the design of highly interactive visual environments. His current focus is on cognitive and emotional aspects of information design and interaction design of simulations and educational games for math and science education. Dr. Plass received his MA in Mathematics and Physics Education and his Ph.D. in Educational Technologies from Erfurt University (PH Erfurt, Germany).

Michelle Riconscente, Ph.D. is Director of Learning and Assessment at GlassLab. Dr. Riconscente brings expertise in evidence-centered assessment design, formative assessment, psychometrics, cognitive science, and instruction to the Lab's innovations in creating game environments and support materials that strongly

link learning and assessment. Previously an Assistant Professor of Educational Psychology and Technology at the University of Southern California, she authored the first controlled study of an iPad learning app, and her published research on student motivation includes mixed-methods investigations of U.S. and Mexican students' subject-matter interest. Dr. Riconscente has served as a consultant to several organizations, including Harvard University, MIT, GameDesk, Scholastic Inc., The Carnegie Corporation of New York, UCLA's CRESST, Motion Math Games, and the U.S. Department of Education. She holds a bachelor's degree in mathematics-physics from Brown University and a Ph.D. in educational psychology from the University of Maryland, College Park.

Rachel Snider is a doctoral candidate in Mathematics Education at the University of Michigan School of Education. She is also pursuing a M.S. in Mathematics at the University of Michigan. Her research focuses on teacher knowledge and reasoning and teacher education. Rachel's dissertation looks at the mathematical knowledge for teaching and reasoning secondary mathematics teachers use as they plan for and carry out the teaching practices of giving explanations and selecting examples. In graduate school, she has spent 2 years as a field instructor for pre-service teachers. Rachel received her B.S. from the University of Michigan in Mathematics. Before graduate school, she spent 3 years teaching high school mathematics in Westwood, Massachusetts.

Tzuchi Tsai is a doctoral candidate in Educational Leadership at the New York University Steinhardt School of Culture, Education, and Human Development. His research focus is on empowerment and the experience of New York City public school principals. Tzuchi is a research assistant for CREATE and holds an M.Ed. in School Leadership from Harvard University, an M.A. in Mathematics Education from Columbia University, and a B.S.E. in Biomedical Engineering from Tulane University. Before graduate school, he spent 6 years in New York City public schools teaching middle school mathematics. In his spare time, he enjoys video games and is a fan of *Little Big Planet* and *Portal*.

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our surveys and participated in our case studies, as well as John Mannes and Joseph Shulman, who contributed to the research at the University of Michigan, and Brianna Avenia-Tapper, who contributed to the research at New York University. The views presented in this work are those of the authors, and not necessarily those of the funder, our partners, or the authors' organizations.



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ENDNOTES

¹ apps.leg.wa.gov/documents/billdocs/2013-14/Pdf/Bills/Senate%20Bills/6104.pdf

² www.usatoday.com/story/tech/gaming/2014/09/12/white-house-video-games/15393169

³ www.brainpop.com/games

⁴ www.joanganzcooneycenter.org

⁵ www.common sense media.org

⁶ g4li.org

⁷ learninggamesnetwork.org

⁸ www.gameslearningsociety.org

⁹ learninggameslab.org

¹⁰ gamedesk.org

¹¹ education.mit.edu

¹² www.cse.ucla.edu

¹³ glasslabgames.org

¹⁴ www.sri.com/work/projects/glasslab-research

¹⁵ www.joanganzcooneycenter.org/wp-content/uploads/2014/10/jgcc_leveluplearning_final.pdf

¹⁶ nces.ed.gov/surveys/sass



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