TEACHING, TECHNOLOGY AND LEARNING

Understanding the interconnection

Research Findings | February, 2016

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INTRODUCTION

The most recently published large-scale research study shows that technology is not having the impact on student learning that we'd all hoped. This revelation has increased the urgency for both educational institutions and industry to work harder to find a more effective approach. SMART Technologies initiated research aimed at uncovering the interconnections between success, technology and teaching/learning practices. The purpose of this research is to help guide decisions in the education and technology sectors.

HIGHLIGHTS

Great teachers get results.

But when they're able to use education technology to enable the best teaching practices, their ability to achieve successful outcomes is greatly enhanced.

The highest success comes from great teaching practices, complemented by software and hardware, in that order.

Teaching practices + **Education software** + **Hardware** = **Success**

342%

more likely to achieve outstanding success when using teaching best practices and technology frequently

70%

achieve positive success when using collaborative software frequently

The Respondents

Research was conducted using over 400 education professionals, with a variety of roles in the education sphere.

Geography

The majority of respondents are from the United States, UK, Germany, Canada, Netherlands and Sweden.

26 other countries are also represented.

More than 400 survey respondents

20%

2%

23%

55%

- Specialists
- Other
- Administrators and IT professionals
- Educators

Experience

The education and technology experience of most respondents is quite high. This allows us to gain deeper insight into the behaviors and practices of those that use technology regularly.

Education ■   Technology ■

	Less than a year	1 year to less than 5 years	5 years to less than 10 years	10 years to less than 20 years	20 years or more
Education	1%	9%	19%	38%	33%
Technology	4%	15%	28%	38%	14%
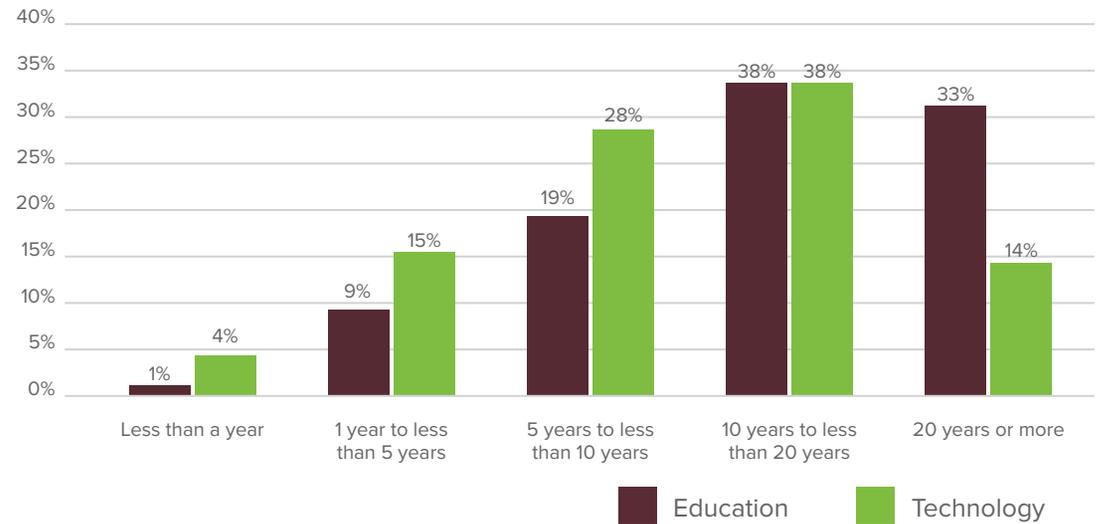
Grade Level

Teachers were primarily drawn from K-12, with some Higher Education representation.
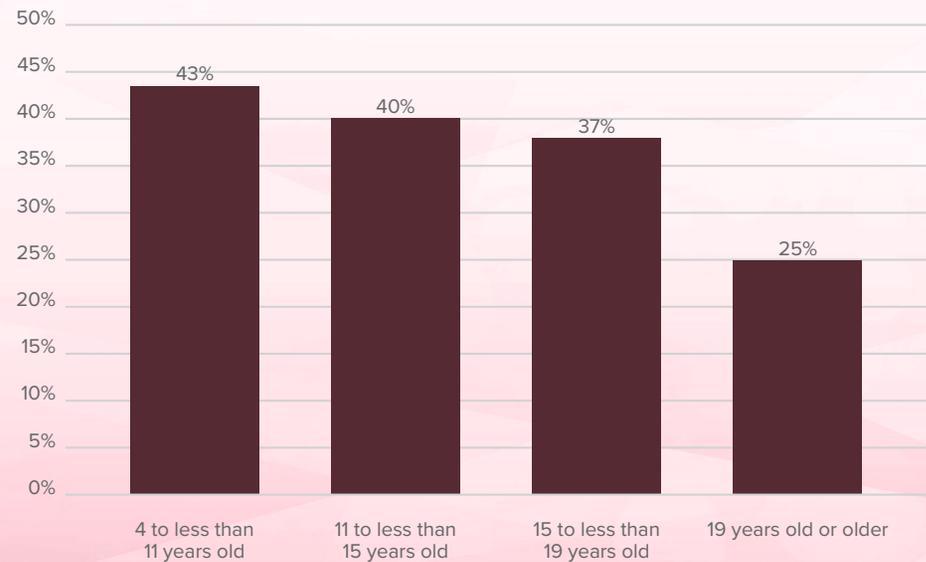
4 to less than 11 years old	11 to less than 15 years old	15 to less than 19 years old	19 years old or older
43%	40%	37%	25%

Conclusions:

- The fusion of great teaching practice with technology-rich environments results in much higher reporting of success

- The frequent use of active learning practices relates strongly to success

- SEL skills are becoming more prioritized than standardized tests by many in the education sphere

- A teacher's view on how learning works relates to success outcomes

- Evidence suggests the importance of software, even over hardware when trying to achieve success

- Assessment software is most closely tied to success, followed by collaborative and content creation software

- Interactive front-of-room display hardware outperforms projectors

- The successful integration of varied technologies in the classroom positively impacts success

- Group activity in the classroom is significantly and positively related to social-emotional skill development and supportive metrics

Challenges:

- Students are mostly using their devices to consume content rather than to create content

- Attention needs to be given to increasing the frequency and quality of collaborative tasks

- Students need to be provided with more opportunities for feedback (daily vs weekly)

- Views on technology as a distraction vary based on teacher experience and student age

Best Practices and Technology

A constant use of best practices paired with a technology-rich environment results in more instances of outstanding success.

	Limited	Mixed	Good	Outstanding

Success

● Constant use of best practices and technology

● Infrequent use of best practices and technology

Success Matrix

This matrix displays the relationship between:

1) How frequently technology is used

2) How frequently best practices are used

3) Reported success

Practice Frequency

Technology Use Frequency

High Practice / Low Tech
7% of Respondents

	Outstanding Success	Good Success	Mixed Success	Limited Succes
	28%	40%	24%	8%

High Practice / High Tech
33% of Respondents

	Outstanding Success	Good Success	Mixed Success	Limited Succes
	38%	28%	25%	9%

Low Practice / Low Tech
28% of Respondents

	Outstanding Success	Good Success	Mixed Success	Limited Succes
	11%	23%	29%	37%

Low Practice / High Tech
31% of Respondents

	Outstanding Success	Good Success	Mixed Success	Limited Succes
	20%	23%	37%	20%

A Connected Approach Works

The findings of the matrix are as follows:	
High Practice/High Technology	3.4x more likely to report outstanding success, if using both technology and best practices frequently, than if using neither frequently.
High Practice/Low Technology	Largely saw good success, and were more successful than Low Practice/High Technology respondents.
Low Practice/High Technology	Saw good and mixed success, but not as much as the High Practice/Low Technology respondents. Yet still saw more success than the Low Practice/Low Technology group.
Low Practice/Low Technology	Substantially less success than any of the other three groupings.

BACKGROUND

OECD Research: Students, Computers and Learning

In September 2015, the Organisation for Economic Co-operation and Development (OECD) released a report concluding, based on their research, that a new approach to technology in schools is needed. This report was used as a starting point for this research, so identifying some of the key points is relevant.

The primary finding was that literacy and numeracy performance scores were not effected by technology.

• Some countries with high adoption of technology ranked lower on literacy and numeracy scores
• Some countries with low adoption of technology ranked higher than most other countries

That said, members of OECD cautioned against drawing conclusions about technology in the classroom based on this finding.

"This should not be used as an 'excuse' not to use technology, but as a spur to finding a more effective approach."

ANDREAS SCHLEICHER

Director for Education and Skills/Special Advisor
on Education Policy
OECD

Other notable researchers in the field have drawn similar conclusions.

"For the last 50 years the average effect size of technology has barely changed. It's not that it can't work...it just hasn't yet."

JOHN HATTIE

Professor of Education and Director
of the Melbourne Education Research Institute
University of Melbourne

OECD Insights

Rather than removing technology from classrooms, the OECD report offers reasons why the impact of technology has not been as strong as it could be. These insights include:

1) **The impact of technology depends more on how teachers use it in the classroom than district or school level policies around the use of technology**

   Training teachers on technology and encouraging them to collaborate on what is working in their respective classrooms has a far larger impact than high-level policy decisions.

2) **It is integral to success that the technology being used promotes teacher-student interaction, not distracts from it**

   Technology that allows students to better interact and receive feedback from their teachers is much more likely to produce positive results.

3) **Technology tools that encourage students to be active participants and promote collaborative learning are key**

   Technology that empowers students to actively participate and create their own content, and to work together with their peers and teachers, produces better results.

Assumptions

Areas to extend the OECD findings include:

- The reliance on standardized test performance as the sole success metric

- Exclusively focusing on computers as classroom technology (excluding front-of-room interactive and non-interactive displays, tablets, smartphones and a variety of software)

- Opportunity to go into more detail on the way students use technology, both in the classroom and at home

Source: OECD (2015), Students, Computers and Learning: Making the Connection, PISA, OECD Publishing.
http://www.dx.doi.org/10.1787/9789264239555-en

Views on Teaching

Findings from the OECD TALIS study indicate most teachers believe that 21st-century pedagogies are integral to their role.
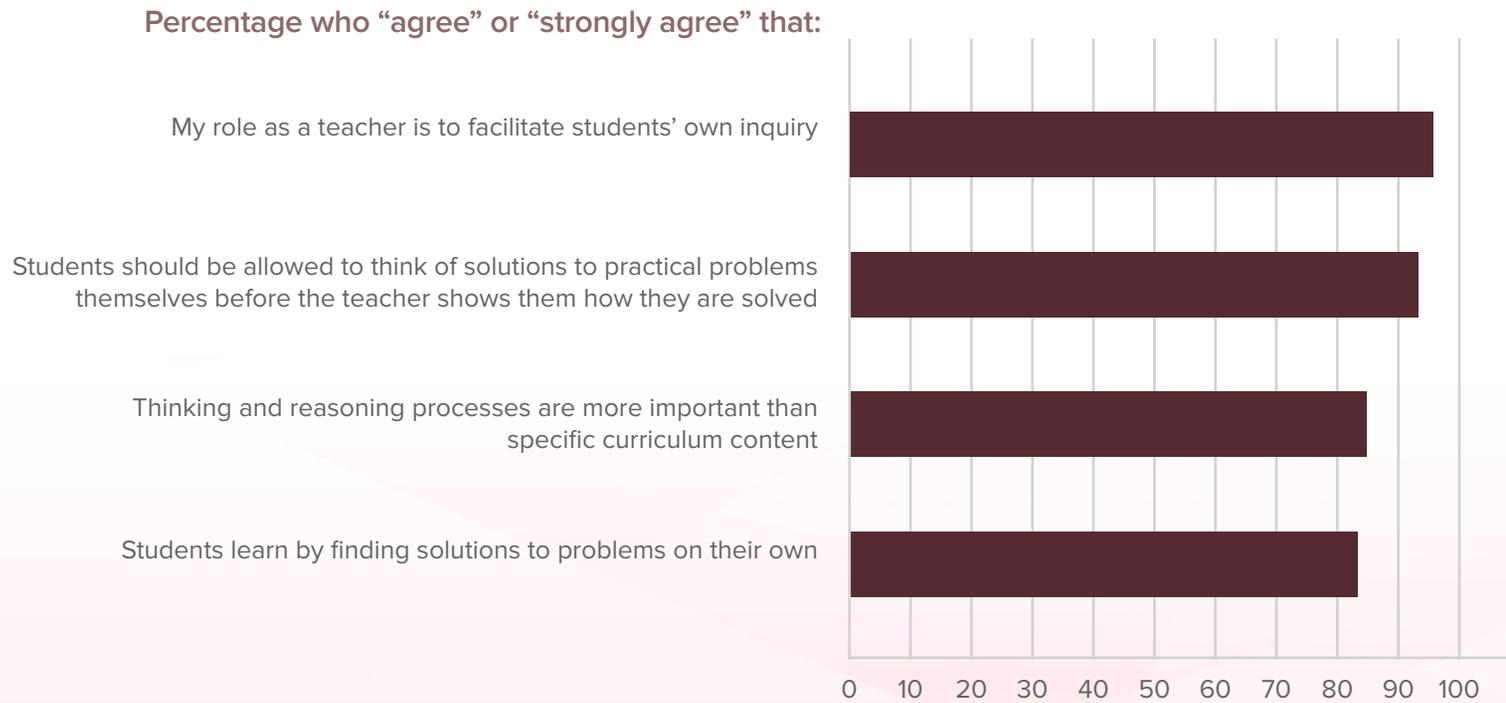
Percentage who "agree" or "strongly agree" that:

My role as a teacher is to facilitate students' own inquiry

Students should be allowed to think of solutions to practical problems themselves before the teacher shows them how they are solved

Thinking and reasoning processes are more important than specific curriculum content

Students learn by finding solutions to problems on their own

0   10   20   30   40   50   60   70   80   90   100

Source: OECD (2014), New Insights from TALIS 2013: Teaching and Learning in Primary and Upper Secondary Education, OECD Publishing. http://www.dx.doi.org/10.1787/9789264226319-en

Yet most teachers don't engage students in ICT work frequently.

Percentage who report using the following 'frequently' or 'in nearly all lessons'*:

Category	Value
Present a summary of recently learned content	~77
Check students' exercise books or homework	~75
Refer to a problem from eveyday life or work to demonstrate why new knowledge is useful	~70
Let students practice similar tasks until teacher knows that every student has understood the subject matter	~68
Students work in small groups to come up with a joint solution to a problem or task	~49
Give different work to students who have difficulties learning and/or to those who can advance faster	~45
Students use ICT for projects or class work	~36
Students work on projects that require at least a week to complete	~28

Axis: 0, 20, 40, 60, 80, 100

And most teachers expressed support with ICT as one of their top PD priorities.

Teachers' Needs for Professional Development

Category	Value
Teaching students with special needs	22.5
ICT skills for teaching	19
New technologies in the workplace	17.5
Student behaviour and classroom management	13.5
Teaching in a multicultural or multilingual setting	13
Approaches to individualised learning	13
Student career guidance and counselling	12.5
Student evaluation and assessment practice	12
Teaching cross-curricular skills	11
Developing competencies for future work	10.5
Predagogical competencies	9.5
School management and administration	9
Knowledge of the subject field(s)	9
Knowledge of the curriculum	8

Source: OECD (2014), New Insights from TALIS 2013: Teaching and Learning in Primary and Upper Secondary Education, OECD Publishing. http://www.dx.doi.org/10.1787/9789264226319-en

Research Approach

This report used the following approach:

- Leverage insights from the OECD report
- Focus on the use of high-impact teaching practices
- Incorporate a larger variety of technology used in classrooms
- Broader success criteria

Classroom Technology

Classroom technology was defined to include:

- Student devices (laptops, Chromebooks, tablets, cell phones)

- Front-of-room technology (interactive whiteboards, interactive flat panels, interactive projectors, projectors, streaming devices)

- Software

High-impact Teaching Practices

Respondents were also asked to identify how frequently they used and engaged students in a variety of teaching/learning practices, including specific active learning pedagogies.

- Teacher clearly defines learning goals and criteria for success before learning begins

- The ability of the teacher to gain insight into the progress of a student's learning and have that insight guide the teacher's next steps

- The use of effective direct instruction

- Active participation of students

- Students applying knowledge in new contexts

- Ample opportunities for feedback (student to teacher & student to student)

- Collaborative learning

Success Measures

The following variables were used to determine success:

Visible learning

Teacher reports greater insight into student learning as it happened and more opportunities to intervene.

Preparation for standardized tests

Students are adequately prepared for standardized assessments.

SEL development

Social and emotional learning – preparing students to be active contributors to society and growing their individual well-being and social progress (ie: life skills, social skills, collaboration, communication & problem solving).

Students feel safe to contribute

In the classroom, students feel safe to contribute their ideas, answers and thoughts without hesitation.

Peer discussion

Students discuss their findings with each other.

Every student participating

Active engagement/rich discussions (everyone is part of the lesson, everyone participates).

Interdependence

Group work involves all participants, not just some.

DETAILED FINDINGS

Views on Teaching Practice

Amongst the respondents, there were two major similarities held almost unanimously about philosophies on how learning works:

98% strongly agree/agree that learning works when students make sense of new material they encounter by striving to relate this new information to their prior knowledge.

98%

97%

97% strongly agree/agree that students also learn by engaging in hands-on activity, so it is better to learn by doing than by being told*

These numbers were particularly high amongst respondents who had been involved in education and using technology for 10+ years.

It should be noted that according to Fiorella and Mayer's generative learning view, 'learning by doing', can focus too much on behavioral activity and not enough on cognitive activity. Doing things does not necessarily cause learning, but thinking about what you are doing does cause learning.

L.Fiorella and R. Mayer, Introduction to Learning as a Generative Activity, Jan 2015

Learn by: Relate new information — Strongly Disagree/Disagree 3%, Strongly Agree/Agree 98%
Learn by: Doing — Strongly Disagree/Disagree 3%, Strongly Agree/Agree 97%
Learn by: Social interaction — Strongly Disagree/Disagree 10%, Strongly Agree/Agree 90%
Learn by: Association — Strongly Disagree/Disagree 32%, Strongly Agree/Agree 68%
Learn by: Practice — Strongly Disagree/Disagree 44%, Strongly Agree/Agree 56%

Strongly Disagree/Disagree

Strongly Agree/Agree

A Teacher's Beliefs on Learning Impacts Success

Participants in the high practice groups more frequently agreed with the notion that learning works by relating new information and by doing than those in the low practice groups.

Practice Frequency

78%

68%

66%

56%

48%

51%

57%

55%

Technology Use Frequency

■ Strongly agree with **Learn work by relate new information**

■ Strongly agree with **Learn work by doing**
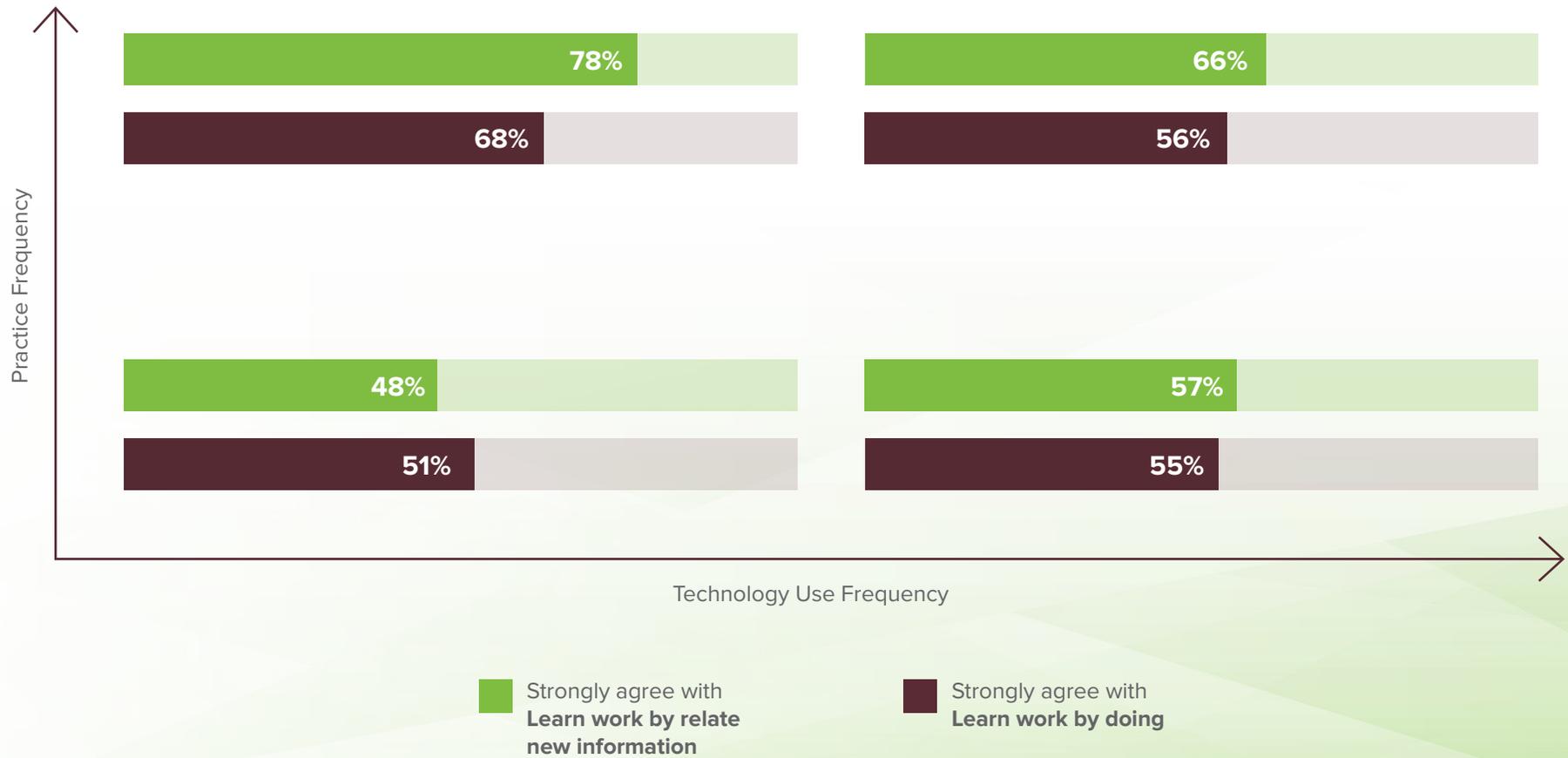
Teaching Practice

Whole-class instruction is the most frequently used teaching method.

Bar chart — Teacher Action: Assign Groups — Never 24%, Monthly 28%, Weekly 31%, Daily 12%, Most Lessons 5%. Teacher Action: Instruct Whole Class — Never 1%, Monthly 5%, Weekly 26%, Daily 47%, Most Lessons 22%.

Legend: Never, Monthly, Weekly, Daily, Most Lessons
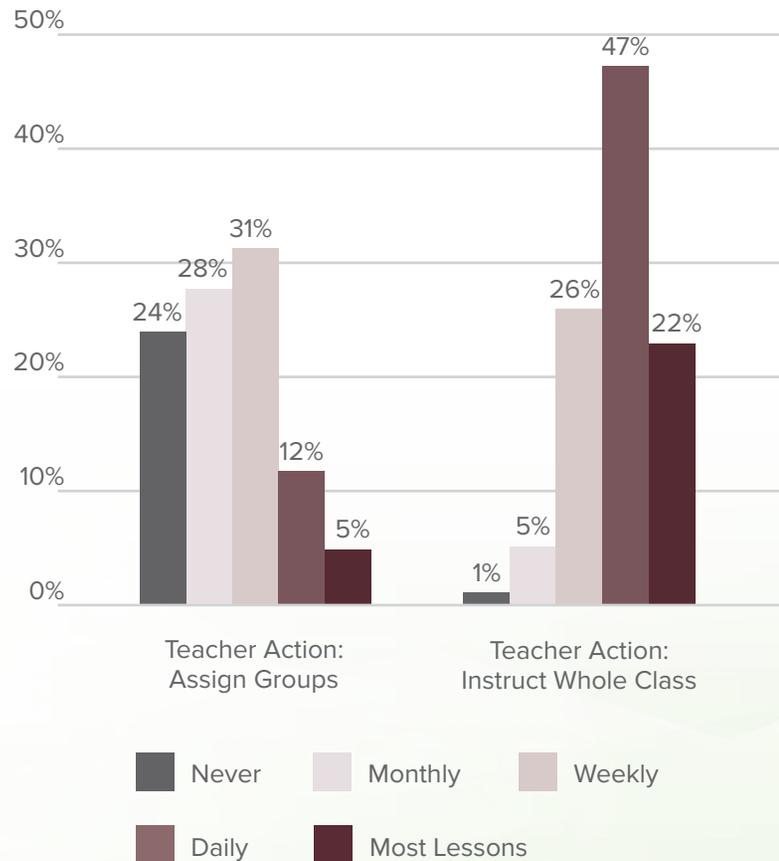
Classrooms that do group activities frequently see the following benefits, when compared to classrooms that do them weekly or less.

- 20% ⬆ social and emotional skill development

- 13% ⬆ safety to contribute (in the classroom, students feel safe to contribute their ideas, answers and thoughts without hesitation)

- 16% ⬆ peer discussion (students discuss their findings with each other)

- 23% ⬆ active engagement/rich discussions (everyone is part of the lesson, everyone participates)

- 27% ⬆ interdependence (group work involves all participants, not just some)

Teaching Practice

The results showed that teaching practices are directly related to success. Some practices and the success metrics most positively impacted by them include:

- Those that reported higher use of project work saw a strong positive impact in 'Visible learning', 'SEL development' and 'Interdependence'

- Assigning collaborative homework is infrequent, but when done reported a strong positive impact in 'Visible learning', 'Peer discussion' and 'Interdependence'

- Providing written feedback daily (rather than weekly, as is more common) resulted in a strong positive impact in 'Students feel safe to contribute', 'Peer discussion' and 'Every student participating'

Legend:
- Never
- Monthly
- Weekly
- Daily
- Most Lessons

Teacher Action: Assign Collaborative Homework — 24%, 28%, 31%, 12%, 5%

Teacher Action: Written Feedback — 7%, 15%, 45%, 22%, 11%
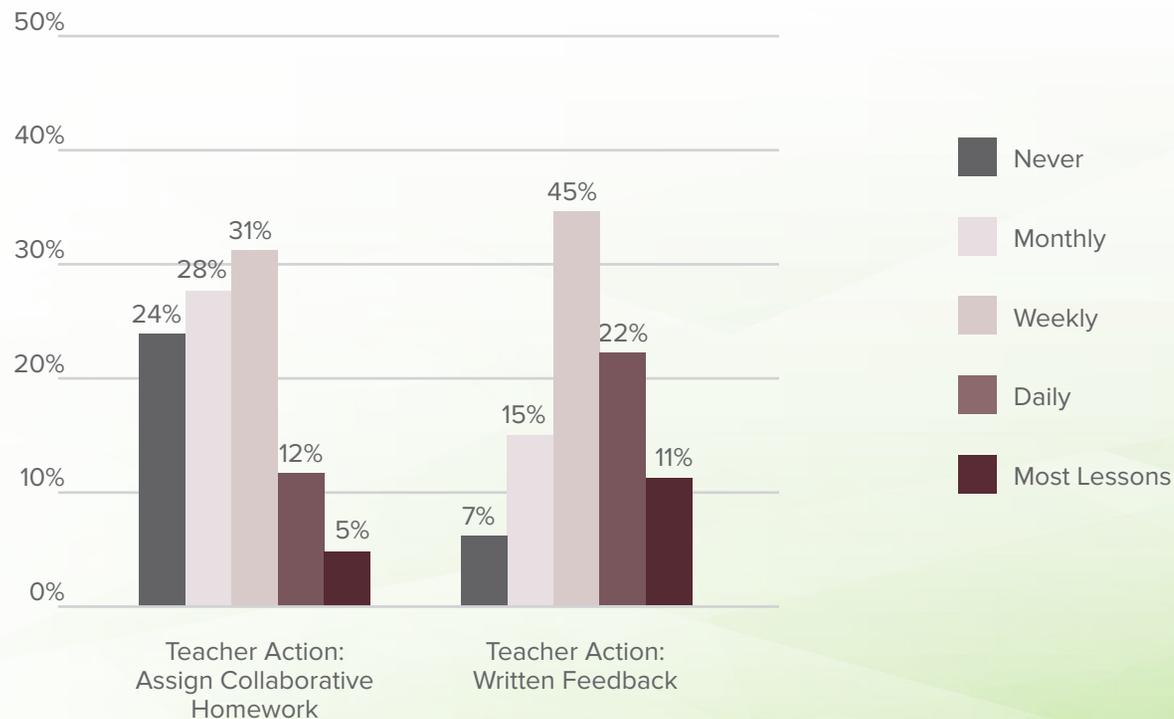
Active Learning

76%

76% of respondents indicated active learning is an important approach at their school.

What is active learning?*

Active learning calls for student participation that is not just social, but involves meaningful cognitive engagement with the content, both individually and collectively.

Common methods to create active learning opportunities include:

- Think-Pair-Share Activities [most common]
- Analysis and Problem Solving Activities [least common, most impact]
- Visualization Activities
- Less Structured Activities

Legend:
- Never
- Monthly
- Weekly
- Daily
- Most Lessons

Source: SALTISE

Chart data:

SALTISE: Think-Pair-Share
- Never: 8%
- Monthly: 22%
- Weekly: 35%
- Daily: 25%
- Most Lessons: 10%

SALTISE: Analysis & Problem
- Never: 14%
- Monthly: 39%
- Weekly: 28%
- Daily: 15%
- Most Lessons: 4%

SALTISE: Visualization
- Never: 13%
- Monthly: 30%
- Weekly: 33%
- Daily: 19%
- Most Lessons: 5%

SALTISE: Less Structured
- Never: 6%
- Monthly: 31%
- Weekly: 39%
- Daily: 18%
- Most Lessons: 6%
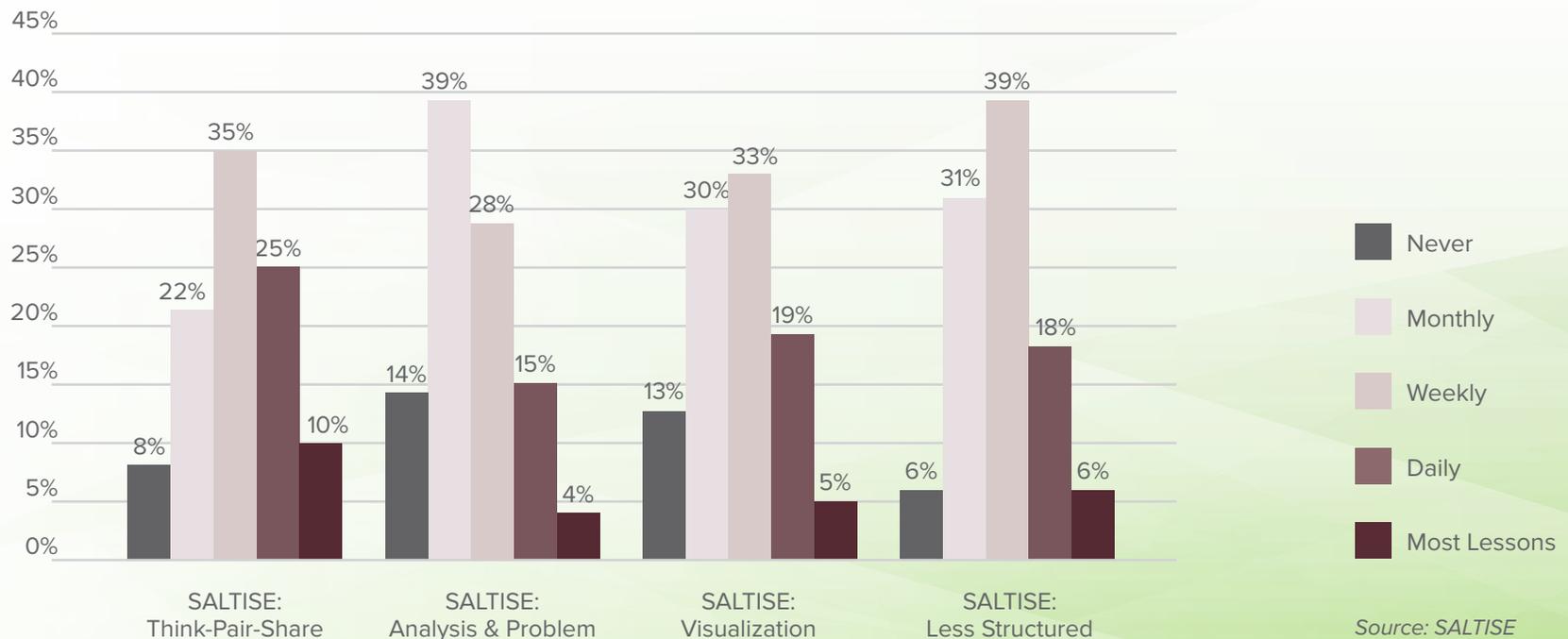
Hardware Usage

Desktop computers and laptops are the most commonly used hardware in the classroom.

Interactive whiteboards
- 19%
- 81%

Interactive Flat Panels/ Display
- 72%
- 28%

Smartphones
- 53%
- 48%

Chromebooks
- 69%
- 31%

Tablets without keyboards
- 43%
- 50%

Tablets with keyboards
- 70%
- 30%

Desktops/Laptops
- 18%
- 82%

0% 10% 20% 30% 40% 50% 60% 70% 80% 90%

Never / Monthly

Weekly / Daily / Most Lessons
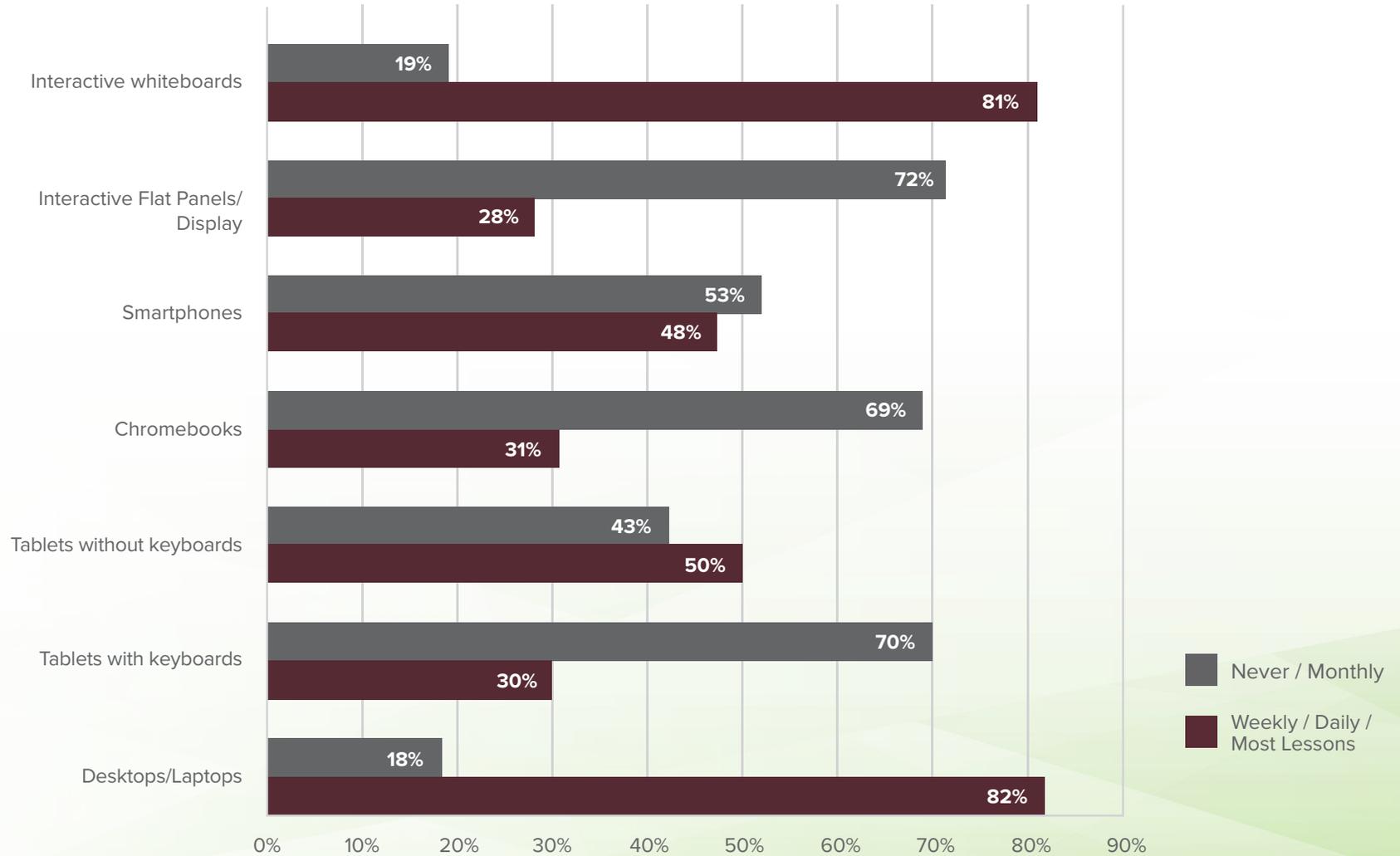
Note: purchasing trends show that Chromebooks will soon disrupt this, though.

Devices

A 1:1 ratio of devices to students is fairly common, with a significant uptake in higher grades.

Ratio of Devices to Students
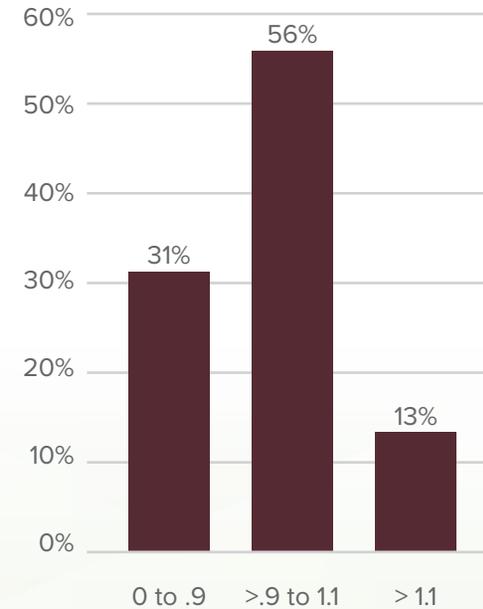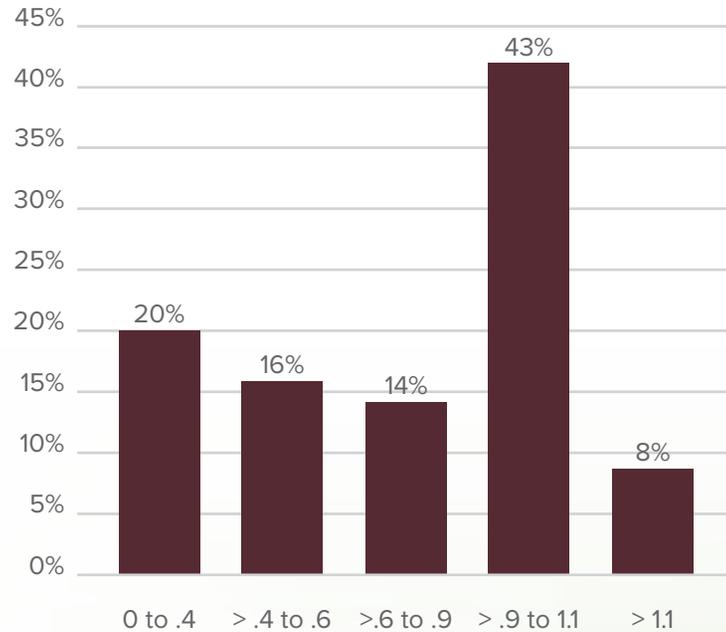
Sharing (ages 4-19)

- Close to 1 :1 reported about half the time

- Under 0.4:1 about 20% of the time

Sharing (ages 19)

- 1:1 ~ 60% of the time

- Close to 1:1 almost all observations

Students' Use of Devices

The majority of students use devices to consume content, yet in trying to develop higher order thinking skills it's known that *creating content is far more impactful than consuming content.*

47% — Consume content daily or most lessons

23% — Create content daily or most lessons

Legend:
- Never
- Monthly
- Weekly
- Daily
- Most Lessons

Consume Content: 4%, 12%, 38%, 33%, 14%
Communicate: 15%, 20%, 34%, 23%, 8%
Interactive Consumption: 4%, 13%, 37%, 38%, 9%
Create New Content: 14%, 31%, 32%, 17%, 6%
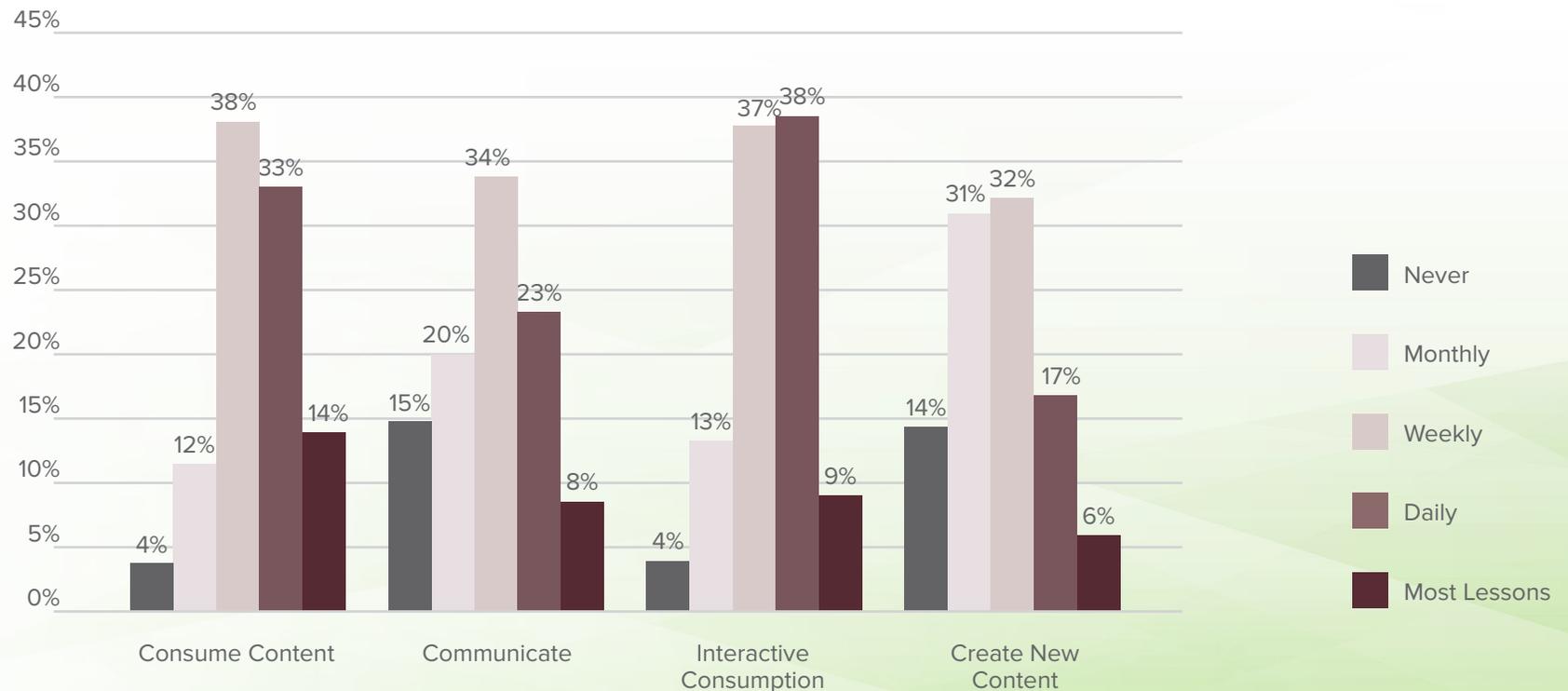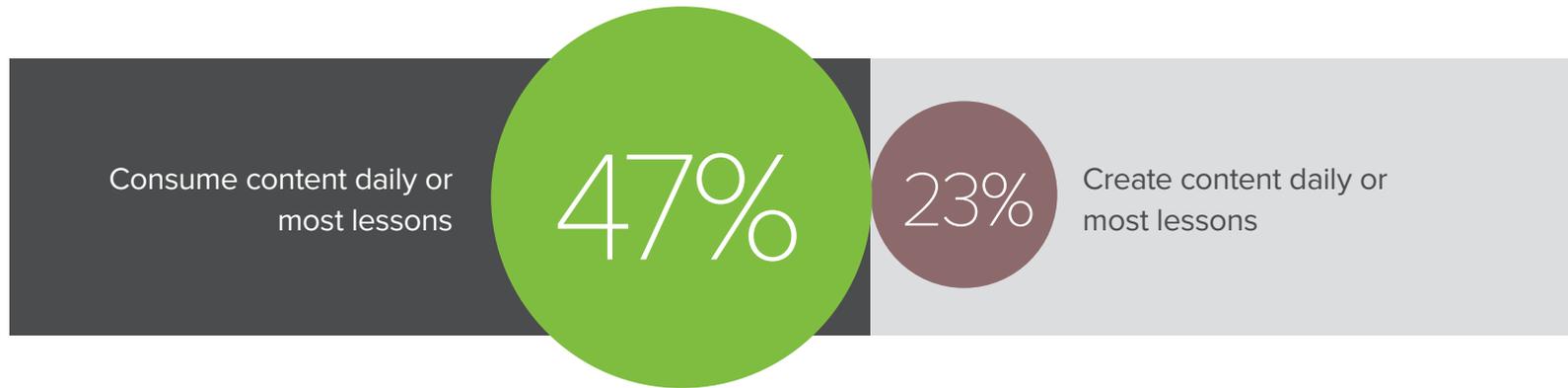
Students' Use of Devices Outside of School

The findings from the previous page are consistent with the latest research from Common Sense Media, which looked at how students make use of media for non-school related tasks. The trend of using devices to consume rather than create content is also present in most students' personal lives.

Tweens

3%
Creation

14%
Communication

37%
Interactive
Consumption

41%
Passive
Consumption

Teens

3%
Creation

26%
Communication

25%
Interactive
Consumption

39%
Passive
Consumption
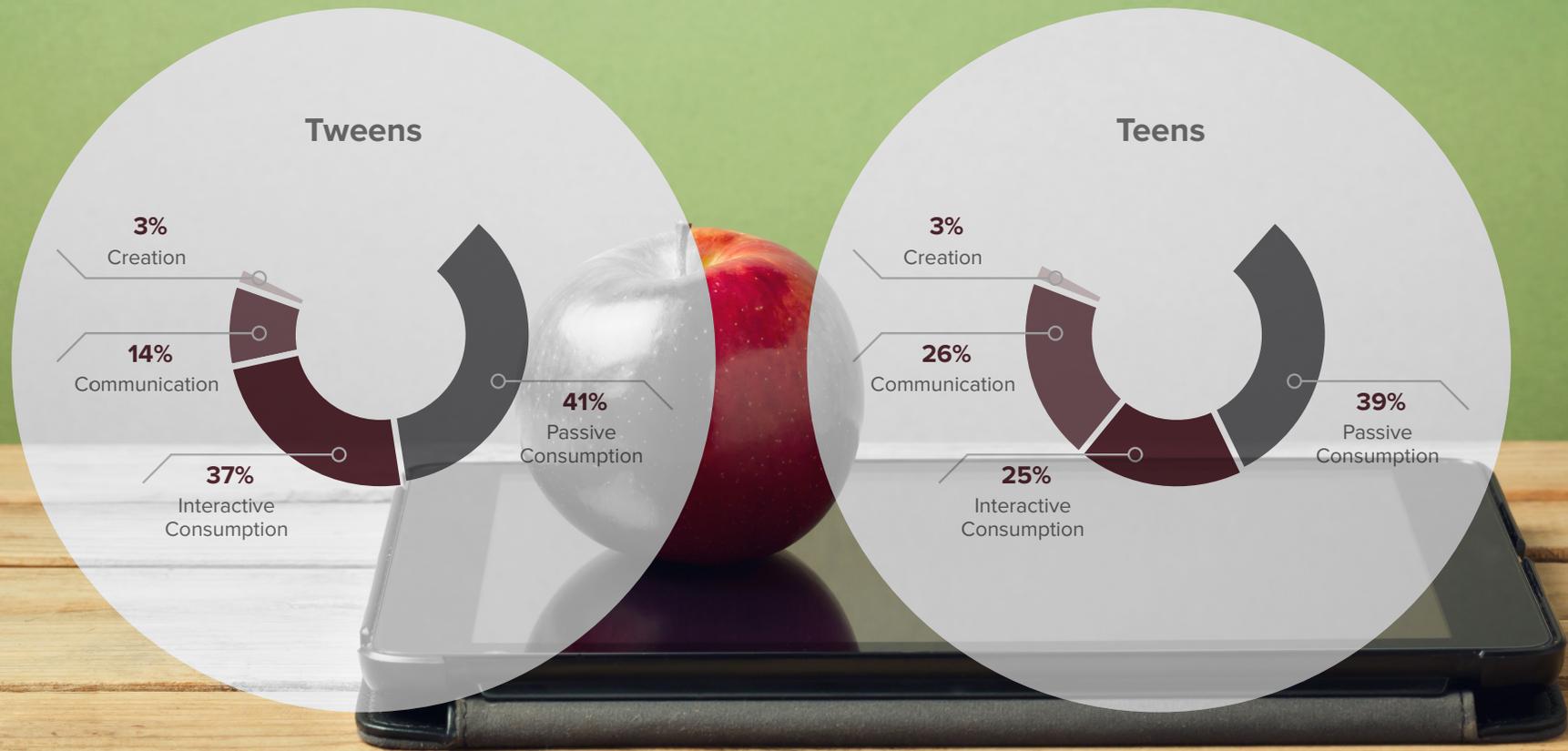
*Source: Common Sense Media Inc. (2015) The Common Sense Census: Media Use by Tweens and Teens

Interactive vs Non-Interactive Hardware

Interactive hardware was defined as:

• Digital capture boards
• Interactive projectors
• Interactive whiteboards
• Interactive flat panels/displays

Those who use interactive hardware frequently saw a more positive impact on the 'Visible Learning' success metric.

Non-interactive hardware was defined as:

• Projectors
• Streaming devices

Those who use non-interactive projectors frequently reported the lowest impact across all success factors.

High Use of Classroom Hardware

	Positive Success	Mixed or Limited Success
Non Interactive	51%	49%
Interactive	60%	40%
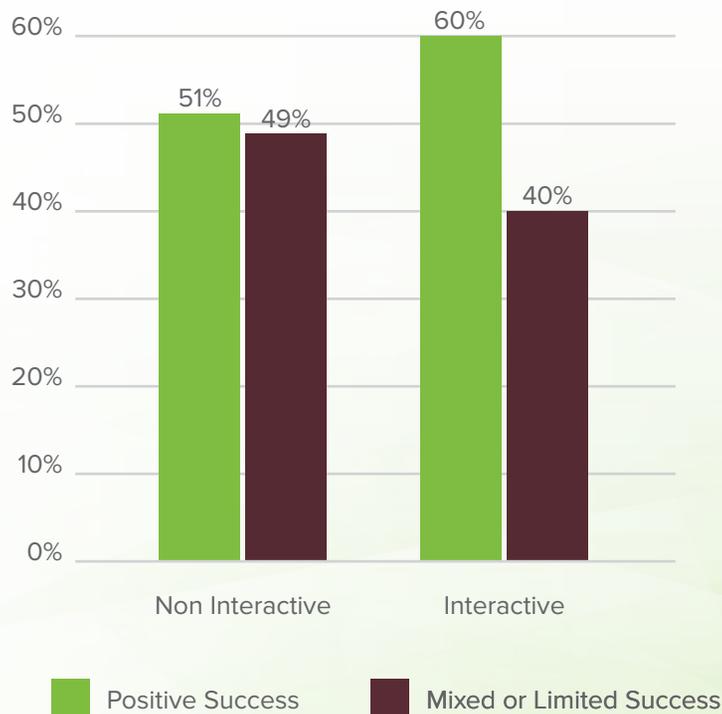
Impact on Insight to Learning

	Non Interactive	Interactive
Infrequent	36%	19%
Moderate	32%	31%
Frequent	31%	51%
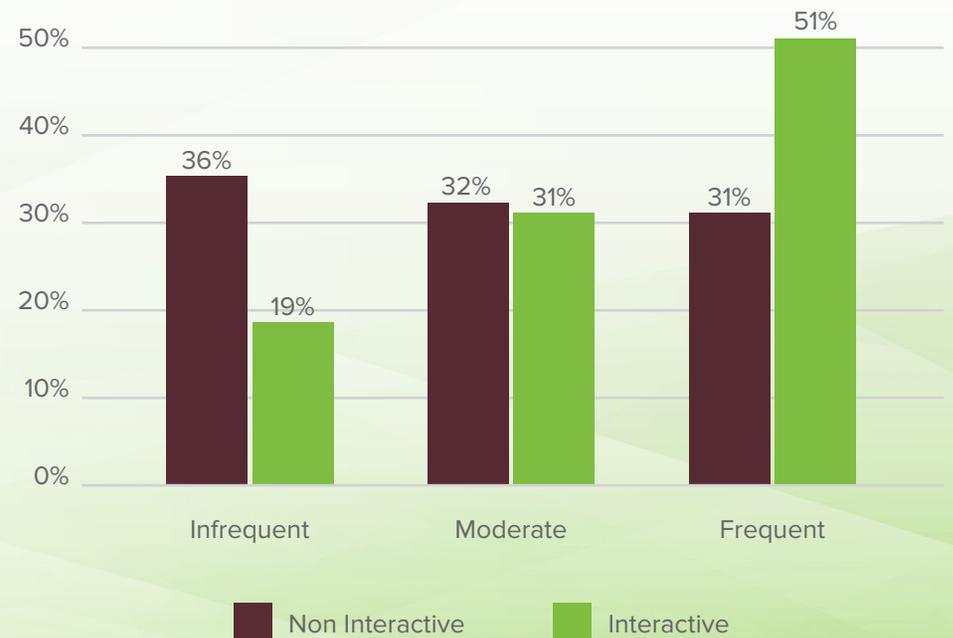
Software vs Hardware

When comparing high frequency users of software and hardware we found that overall software is more closely related to success than hardware.

Below represents just a sample of the data:

Software

- Positive success
- Mixed or limited success

Whole-class Collaborative Software
- 30%
- 70%

Student Co-Creation Software
- 32%
- 68%

Assessment Software
- 33%
- 67%

Gamification Software
- 34%
- 66%

Hardware

- Positive success
- Mixed or limited success

Tablets
- 37%
- 63%

Laptops, PCs
- 47%
- 53%

Smartphones
- 48%
- 52%

Non-Interactive Projectors
- 53%
- 47%
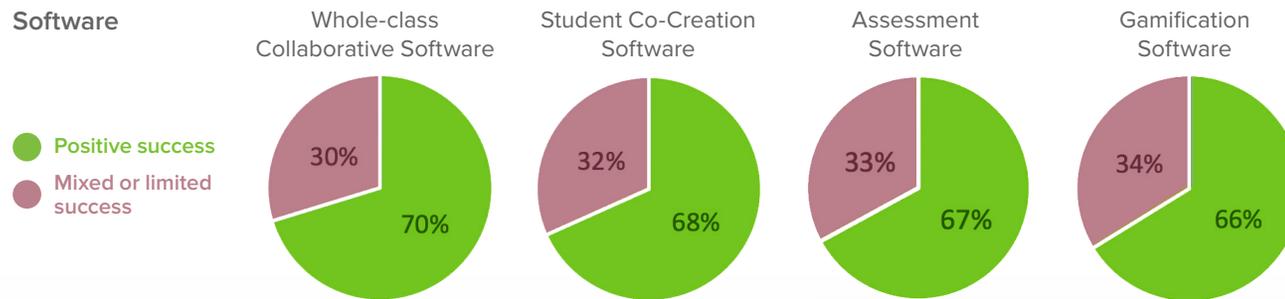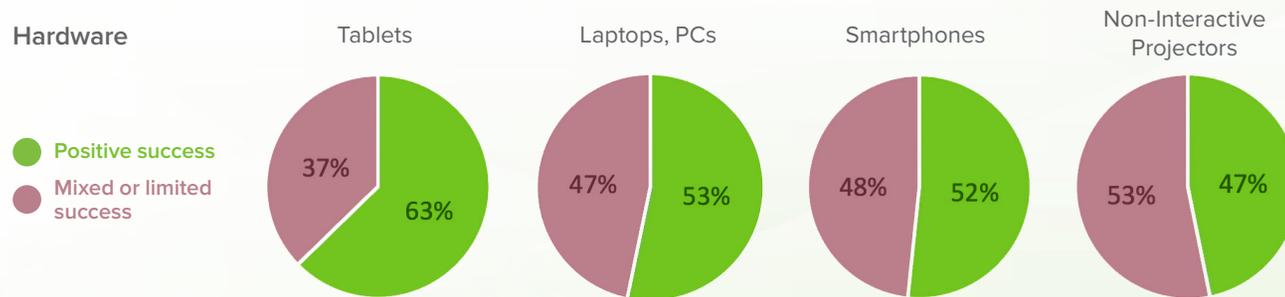
Learning Strategies

While the strongest impact on success measures came from assessment and collaboration software, it is more common for students to work individually. They also tend not to receive feedback daily.

Chart legend:
- Never
- Monthly
- Weekly
- Daily
- Most lessons

Student Action: Indivudual
- Never: 1%
- Monthly: 9%
- Weekly: 28%
- Daily: 49%
- Most lessons: 12%

Student Action: Groups
- Never: 2%
- Monthly: 9%
- Weekly: 37%
- Daily: 41%
- Most lessons: 11%

Student Action: Projects
- Never: 11%
- Monthly: 51%
- Weekly: 24%
- Daily: 10%
- Most lessons: 5%

Student Action: Feedback
- Never: 6%
- Monthly: 22%
- Weekly: 39%
- Daily: 25%
- Most lessons: 8%
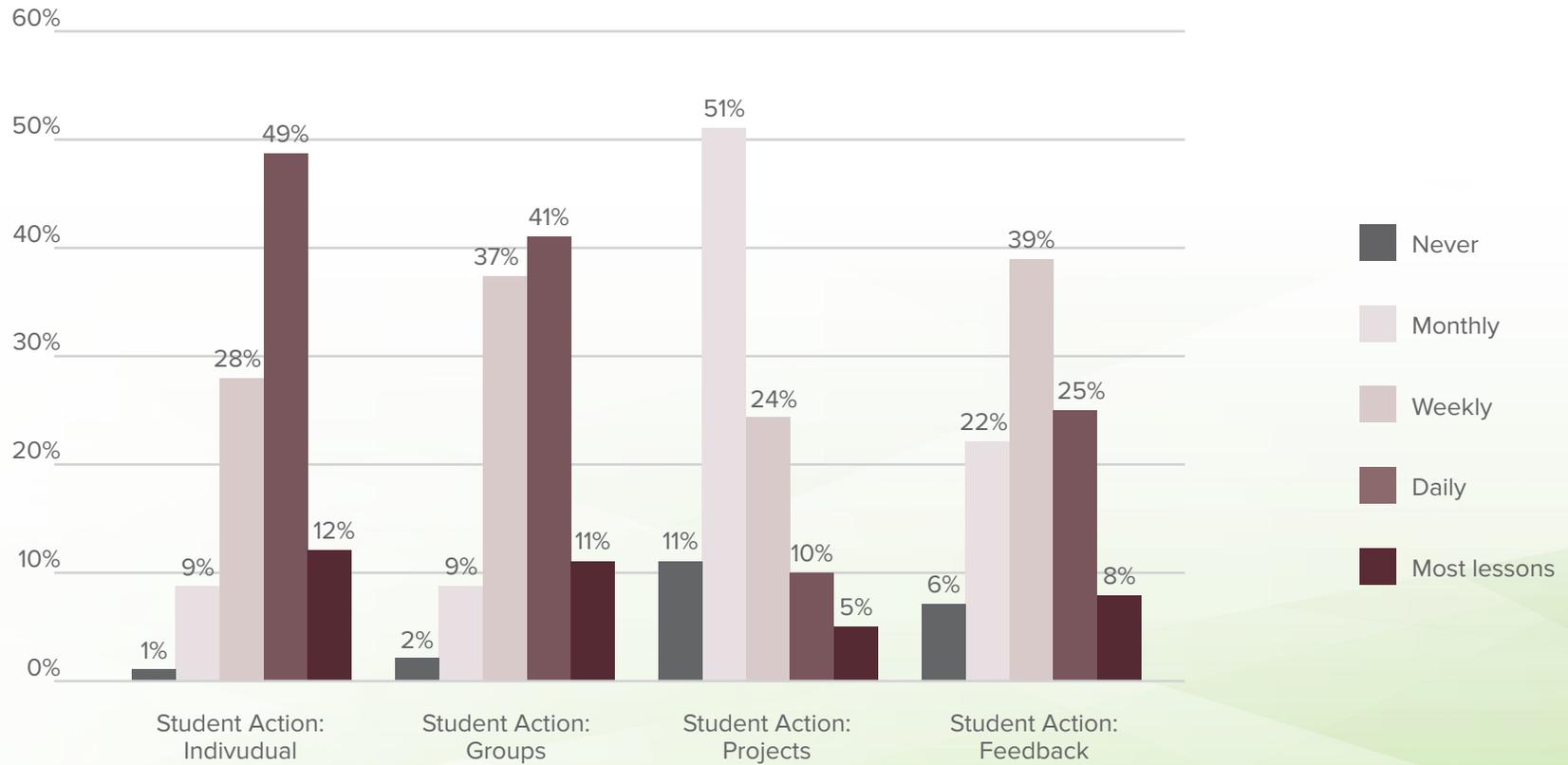
Collaboration

Though collaborative tasks are used less frequently in the classroom, the data indicates that when they are used frequently, success follows.

High Frequency Practice

Low Frequency Practice

Legend: Never, Monthly, Weekly, Daily, Most Lessons
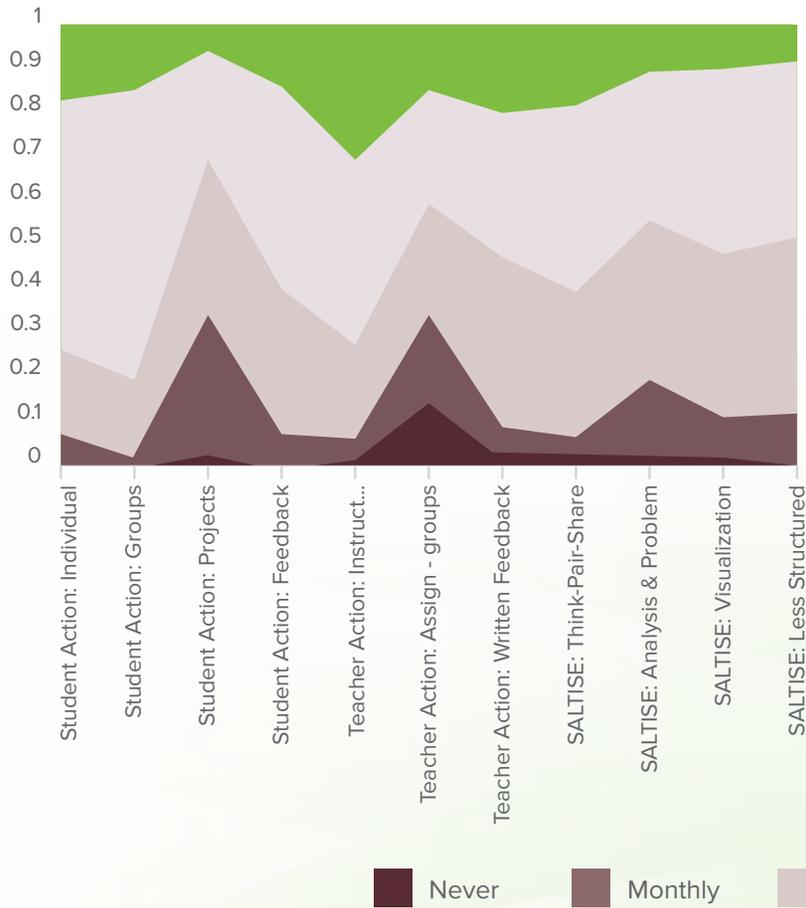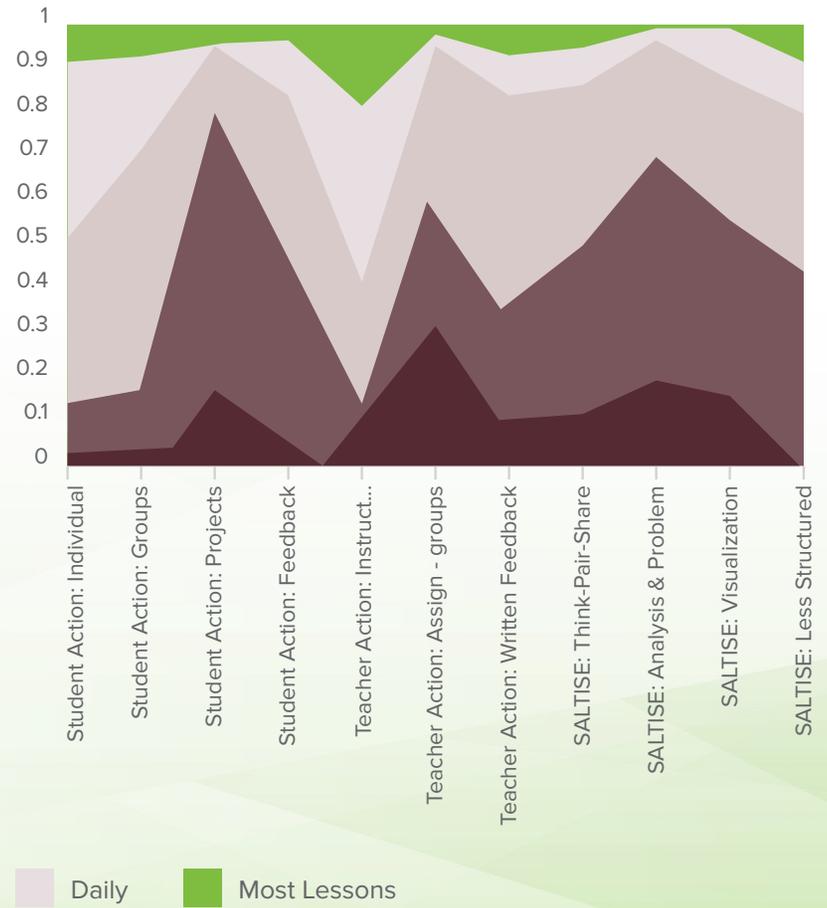
Integration

Those who reported successful integration of their classroom technology (integrating devices, hardware and software) consistently reported better success.

Level of Integration

No/Minimal Impact

Very Strong Positive

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Device Distraction

Views on whether devices are a distraction in the classroom revealed trends that are particularly relevant when planning professional development.

Teachers with more experience are less likely to have concerns about devices being a distraction.
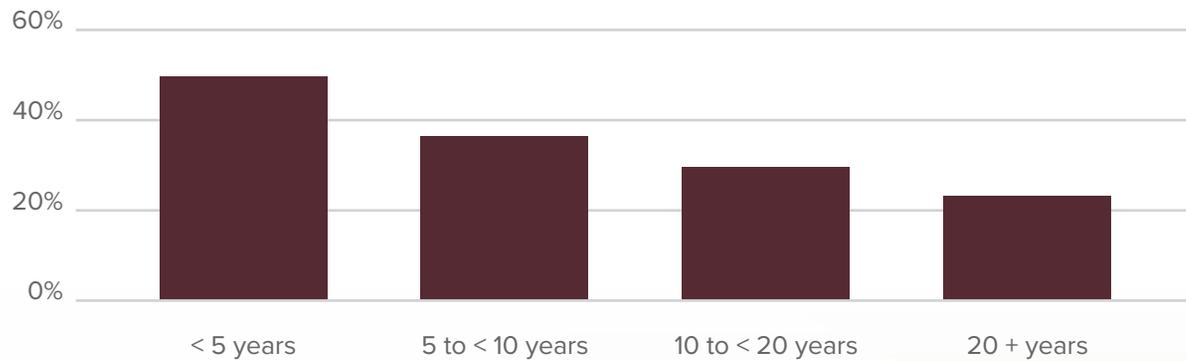
As students get older, their teachers are more likely to have concerns about devices being a distraction.
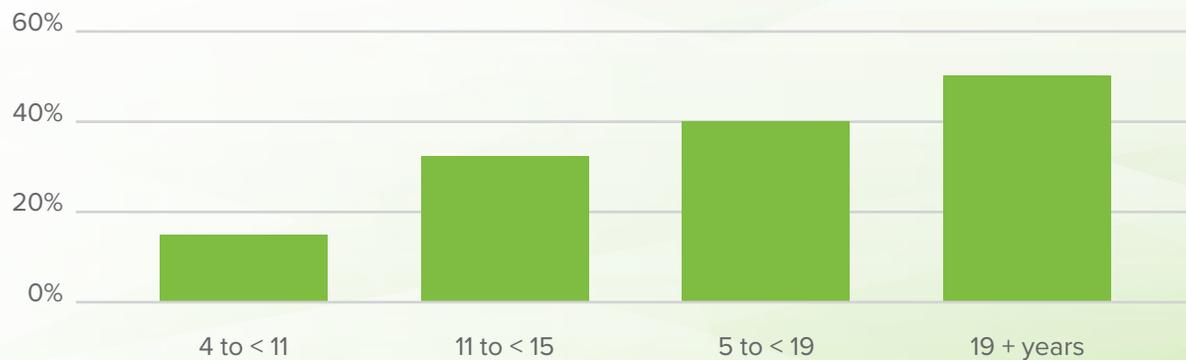
Challenges Associated with Technology

When asked to relate the most pressing challenges faced, respondents identified:

Choosing technology for specific teaching approaches and students' variations (in age, skills or knowledge)

16%

14%

Time or resources to learn the technology, planning and creating curriculum with the technology and content availability
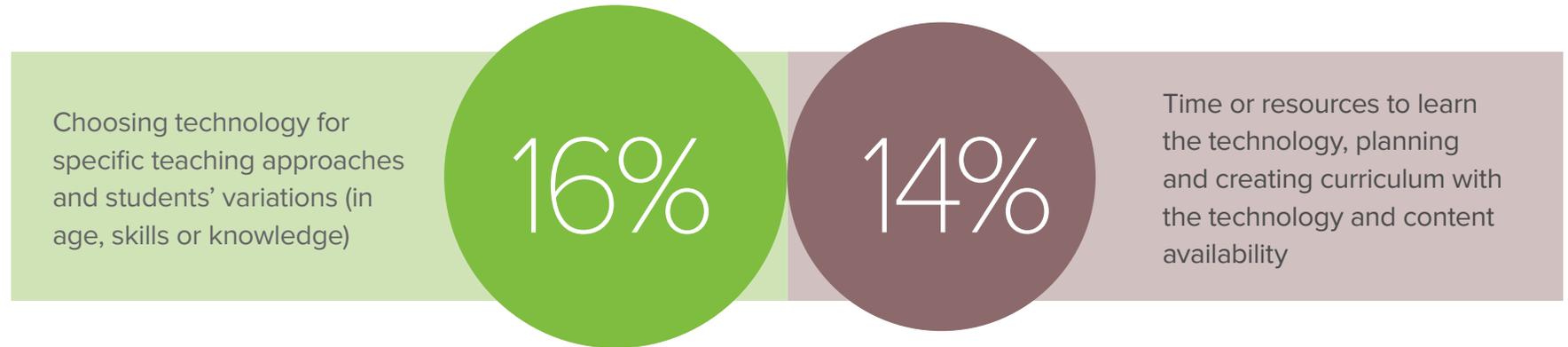
"My top challenge is navigating through what technology works best and well with and for my students, and for what projects and/or classwork."

- Survey Respondent

"The top challenge for me is to make teachers realize that effective teaching is not about the technology but about the pedagogy."

- Survey Respondent

Reported Achievements

Investment in pedagogy and technology impacts SEL skills more than standardized test preparation.

Success

Legend:
- Minimal / Some Positive Impact
- Strong / Very Positive Impact

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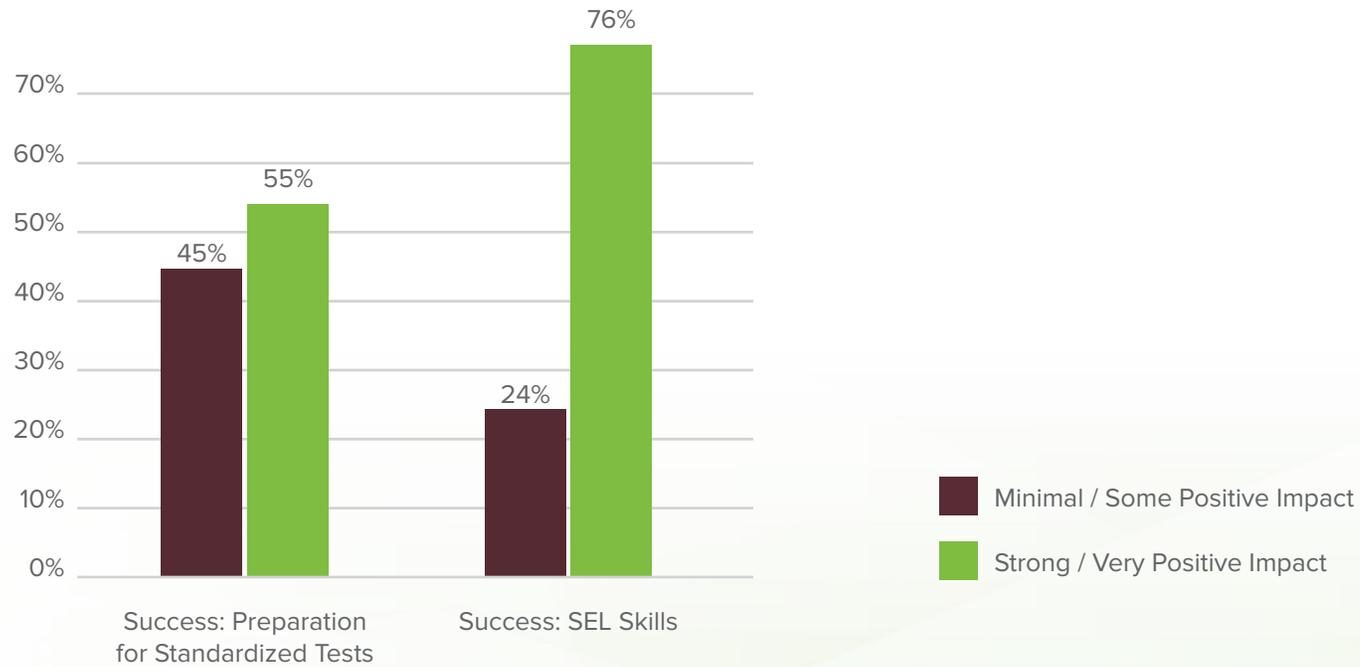
Reported Achievements

The impact of investment in pedagogy and technology on in-classroom teaching practice:

- *'Students feel safe to contribute', 'Peer discussion'* and *'Every student participating'* all demonstrated positive success

- *'Interdependence'* showed the least positive impact

Legend:
- Minimal / Some Positive Impact
- Strong / Very Positive Impact

Bar chart values:
- Success: Students Feel Safe to Contribute — 23% / 78%
- Success: Every Student Participating — 26% / 75%
- Success: Peer Discussion — 27% / 74%
- Success: Visible Learning — 31% / 69%
- Success: Interdependence — 34% / 66%
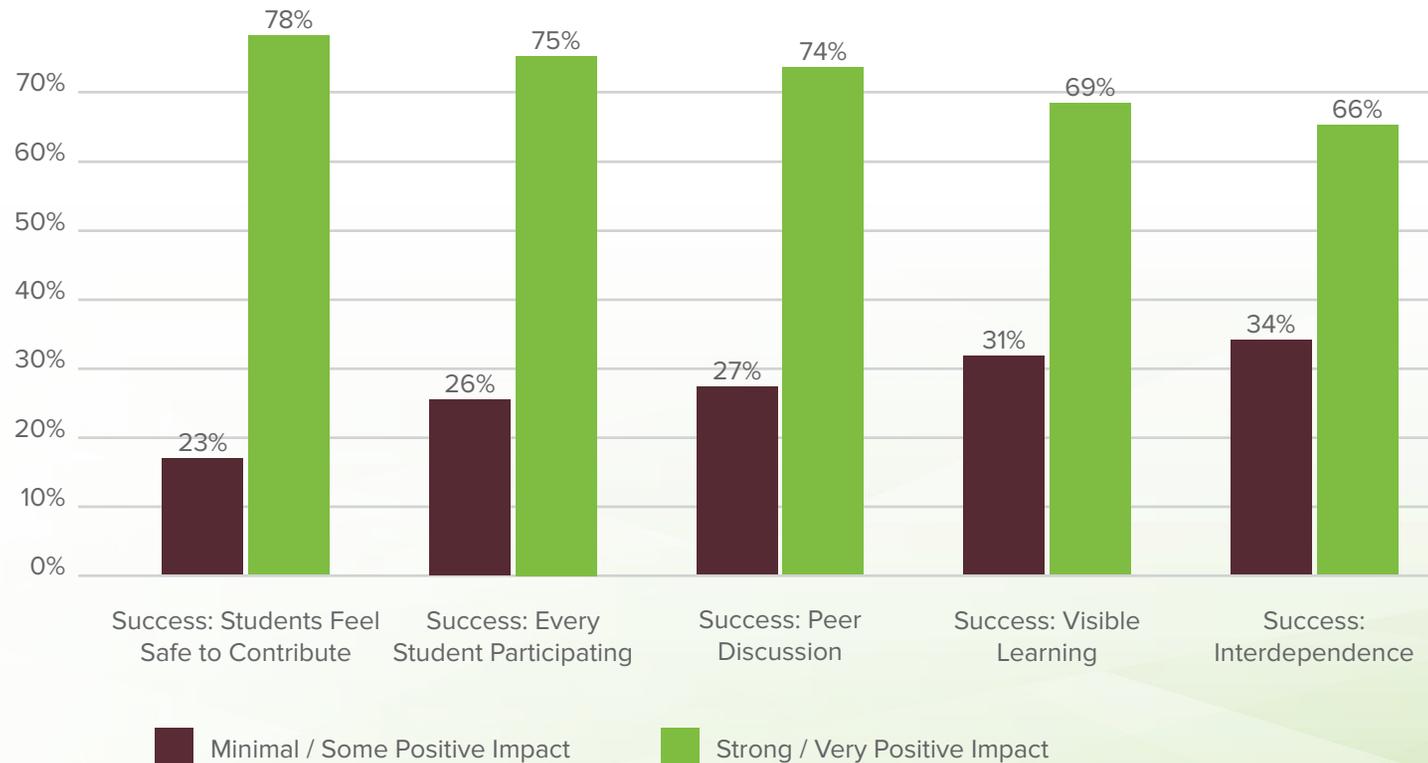
As achieving higher forms of collaborative practices (interdependence) is the lowest rated, the suggestion is that it requires further attention.

CONCLUSIONS

Conclusions:

- The fusion of great teaching practice with technology-rich environments results in much higher reporting of outstanding success

- The frequent use of active learning practices relates strongly to success

- SEL skills are becoming more prioritized than standardized tests by many in the education sphere

- A teacher's view on how learning works relates to success outcomes

- Evidence suggests the importance of software, even over hardware, when trying to achieve success

- Assessment software is most closely tied to success, followed by collaborative and content creation software

- Interactive front-of-room display hardware outperforms non-interactive projectors

- The successful integration of varied technologies in the classroom positively impacts success

- Group activity in the classroom is significantly and positively related to social-emotional skill development and supportive metrics

Challenges:

- Students are mostly using their devices to consume content rather than to create content

- Attention needs to be given to increasing the frequency and quality of collaborative tasks

- Students need to be provided with more opportunities for feedback (daily vs weekly)

- Views on technology as a distraction vary based on teacher experience and student age

In Closing

Whereas some research (including the OECD report) leads us to conclude that technology can amplify great teaching, but not replace poor teaching, this research finds differently. It indicates that while technology can certainly amplify great teaching, it can also help those with poor practices find greater success.

That said, accelerating the impact of technology in education requires a more effective approach. An approach that considers the various interconnections of hardware, software, high-performing pedagogies and classroom contexts. Insight gathered from this type of approach will not only actualize the potential of existing classroom technology, but also spur its more effective use across the globe.

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