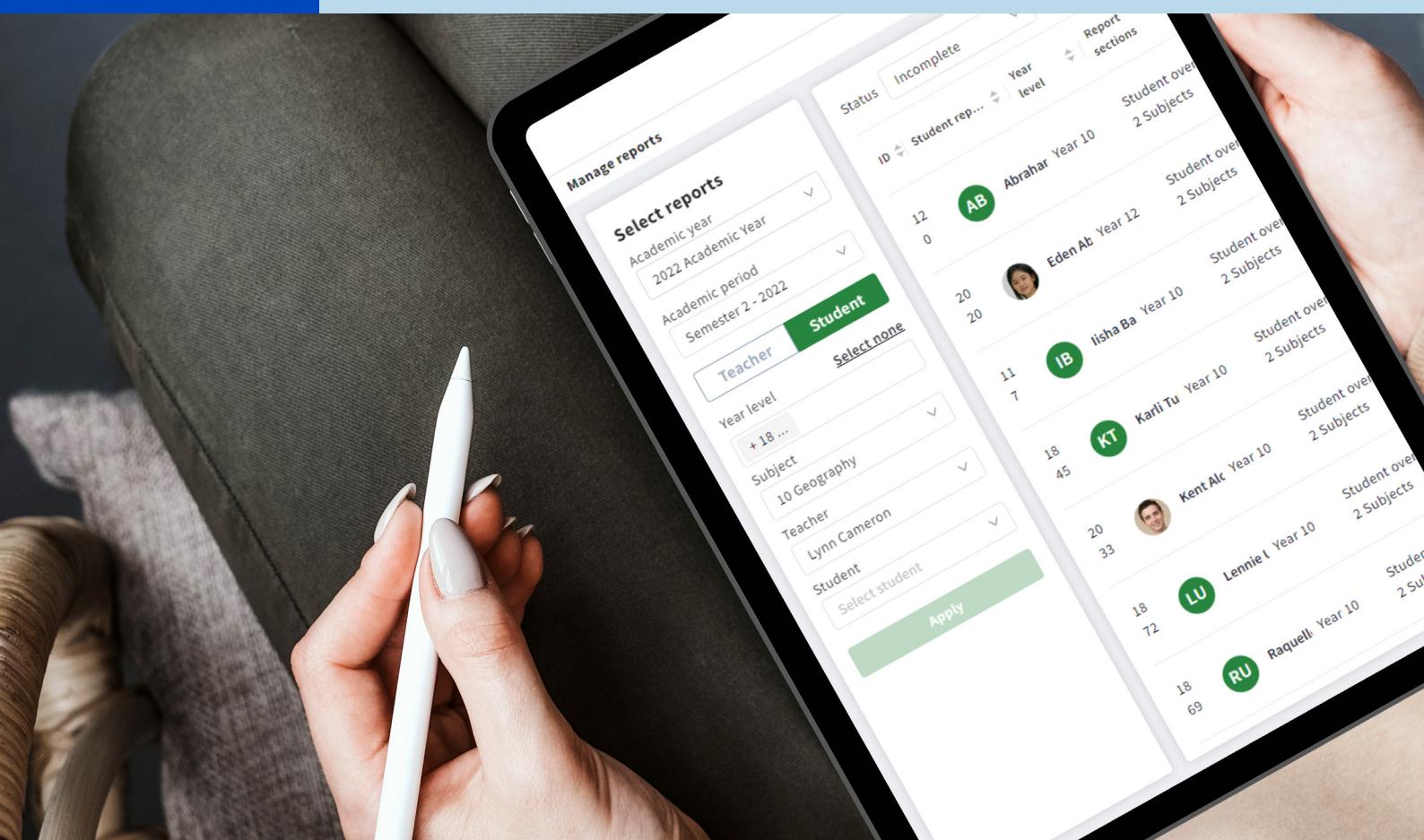




Navigating Ed-Tech choices to maximise impact:

Understanding how different
generations of Ed-Tech software
can add value for schools



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School leaders are facing more technology choices, opportunities and challenges than ever before. How schools navigate the complex maze of technology planning and delivery will increasingly determine their ability to succeed into the future.

In this whitepaper, Education Horizons explores key issues confronting school leaders today and the steps they can take to best position their schools for the future.

1. The changing technology landscape for schools

Ed-tech utilisation and spending are growing significantly in absolute terms and as a proportion of overall school budgets. This is happening alongside rising user expectations, increasing use of unauthorised “shadow IT”, and powerful education mega-trends that are driving increased reliance on technology. Navigating these changes is particularly challenging when selecting and deploying the core systems school staff rely on to keep each school running – their School Management Systems (SMS)¹ and Learning Management Systems (LMS). These systems in particular require wholesale change across many areas of school activity, impacting users across the whole school community. Selecting and deploying the right core operating system is therefore one of the most challenging decisions facing school leadership teams today.

Understanding the history of education technology approaches is important in this decision-making process, as the strengths of any core system or technology

approach are significantly shaped by its origin. Most School Management Systems were created to address a specific need in a particular school – often beginning as basic accounting/administration software, before following school workflows to provide central records management, communications, timetabling and reporting, among other functions. In contrast, modern Learning Management Systems generally began life as one of:

- A purpose-built teacher support tool;
- A university lecture tool; or
- An interface “skin” for an existing school management system.

These different starting points have significantly impacted how each of the available LMS options have evolved toward their current role as contemporary K-12 teacher tools. Today most LMS options support some combination of attendance, wellbeing, learning progress, feedback, reporting, teacher planning, content management and content delivery.

Understanding how the different origin points of core operating systems shape their respective strengths is an important first step in how school leaders approach this critical area of decision-making.

¹ Other related terms include Management Information Systems (MIS), School Management Information Systems (SMIS) and Student Information Systems (SIS)

2. Three generations of core ed-tech

There are three distinct generations of core education technology approaches in market today – each with different capabilities.

First generation education technology:

Combination of bespoke "homegrown" software, generic software tools (documents/spreadsheets/email) and physical paper records

For some schools today, their core operating technologies are made up of a combination of generic spreadsheet/document/email software tools, physical file creation and storage and, in some instances, bespoke software created for that individual school or system. While these first generation approaches enjoy the benefit of familiarity, they tend to deliver limited functionality, with poor integration between technologies and manual processes, resulting in inconsistent data and poor security. Schools still relying on first generation approaches should be exploring transition to later generation school-specific core operating systems as part of a more integrated and reliable technology ecosystem.

Second generation education technology:

Comprehensive school-specific operating software, designed or rearchitected to support large numbers of schools across diverse operating environments

Second generation technologies make up the bulk of the core systems operating in schools today – across both SMS and LMS categories. Many second generation systems began life as bespoke software developed for individual schools, before significant replatforming and rearchitecting to deliver a product option suitable for large numbers of schools across diverse operating contexts. Many of these products are defined by rich feature sets, comprehensive alignment to school-specific needs and proven functionality. Ongoing investment in enhanced security and user experience improvements as well as evolution to cloud hosting continue to extend the life of these products well into the 2030s.

Comprehensive support for unique school needs, strong user familiarity, and complex customisations and configurations are important strengths of second generation systems. These strengths, coupled with the cost and complexity of changing core systems, make these effective options for many schools over the next decade. Providers of second generation

software are and will be heavily motivated to retain customers and ensure the longevity of their products for the long term (at least the next decade).

This gives schools time to optimise their use of their current products and plan any future transition to third generation software.

Third or "next" generation education technology:

Post-2020 "Vertical SaaS" products leveraging full cloud benefits, design innovations and deep understanding of school-specific needs

Third generation education technology systems are emerging in the market today. Defined by full utilisation of cloud-native benefits and modern design innovations, these systems are in the early stages of their development. Their intuitive user interfaces and innovative workflows represent an important step forward in the industry but will require time to approach functional parity with proven second generation systems.

Third generation products are well positioned to benefit from decades of education technology lessons – including breaking down the SMS / LMS barrier and moving beyond "all-in-one" vs. "best-of-breed" debates. "API-first"² design approaches will allow these systems to sit at the heart of each school's technology ecosystem – providing a "single source of truth" and supporting faster development and simpler configuration with more secure and flexible integrations.

Across the broader technology landscape, history suggests that next-generation technologies take considerable time to progress from launch to becoming industry-standard. Decade-long transition schedules are the norm for significant technology shifts including telecommunications networks (2G, 3G, 4G, 5G), hardware (smartphones), and business operating systems (Microsoft Windows). A similar time frame is likely to apply to transition to next generation ed-tech operating systems – ensuring significant continued investment in, and reliance on, proven second generation technologies over this period. Schools will therefore be able to identify their own planning and transition schedules within this overall time-frame, as functionality within third generation products expands.

As part of their planning for any future transition, school leaders will also need to explore the evolving role of non-school-specific, or "horizontal software", alongside their core operating systems.

² Application Programming Interface – A defined set of rules enabling different applications to communicate with each other

3. Vertical and horizontal software

Generic software systems, or horizontal SaaS, are products designed to serve the common needs of every sector and customer – for example: Microsoft 365; Microsoft Dynamics; Google Suite; Salesforce; Netsuite; Xero; Sage; and Quickbooks. These systems have always competed with vertical (or sector-specific) software including rapidly growing vertical SaaS products that focus on the unique needs of a specific sector such as mining, hospitality, healthcare and K-12 education.

Vertical software will remain at the heart of education technology as schools continue to face a number of unique challenges which require sector-specific solutions including:

- **Family relationships**
Managing duty of care and complex fees and billing
- **Student wellbeing and engagement**
Nuanced, rigorous and complex data management
- **Student learning progress**
Connecting wellbeing and learning, managing ongoing feedback

In contrast, the needs of some areas that have traditionally been served by school-specific software may increasingly be met by evolving horizontal SaaS solutions, for example:

- **General ledger management**
(Xero, MYOB, Sage, Netsuite)
- **Virtual classroom and content delivery**
(Teams, Google Classroom)

Another critical consideration for school leaders navigating complex education technology decisions is understanding which needs can only be met by school-specific vertical software, and which can be met by generic horizontal options.

4. Summary of key considerations for school leaders

- School leaders face unparalleled choice, pressure, and complexity in their technology decision-making
- Education technology is central to school success and will become more so
- All schools should at least be using vertical second or third generation software – avoiding the costs, risks and limitations of first generation approaches (mix of homegrown, manual process and generic spreadsheets/documents/email)
- For many schools today, continuing to make the most of the proven breadth and depth of current second generation software presents a powerful option for meeting their school's needs and minimising the cost and complexity of change
- Providers of second generation software are and will be heavily motivated to retain customers and ensure the longevity of their products for the long-term (at least the next decade)
- The long-term future for schools will ultimately be third generation software designed specifically for schools, fully integrated with appropriate horizontal SaaS products
- A growing number of schools are well-placed to transition to third generation technologies today, allowing them to capture the cloud-native and innovative design benefits of these technologies sooner
- Overall industry transition to third generation education technologies will occur progressively over the next decade, reflecting experience in other sectors and technologies
- Schools should use this time and space to begin considering and planning for transition to third generation technologies – at a time that suits them
- Horizontal software solutions will not be able to meet all of the unique needs of K-12 schools and will be most effective working alongside a core vertical school operating solution
- Finding the right mix of horizontal and vertical software is essential to this transition planning – based on understanding which school-specific needs can best be met by vertical SaaS tools – and exploring where evolving horizontal SaaS products fit within each school's technology ecosystem



School leaders today are facing more technology choices and challenges than ever before.

Technology investment and utilisation is becoming increasingly central to school growth and to the delivery of student outcomes. School leaders are grappling with an explosion in software products, cyber threats, and expectations – from parents, students and staff.

How schools navigate the complex maze of technology planning and delivery will increasingly determine their ability to succeed into the future.

In this whitepaper, Education Horizons' leaders outline some of the key questions confronting school leaders and important considerations shaping how they can best position their schools for the future, including:

- 1. The rapid technological changes taking place in and around schools today – and the pressures driving education technology change into the future**
 - First generation education technology approaches made up of combinations of basic digitisation (through spreadsheets, documents and email), manual physical records and bespoke "homegrown" software development;
 - Second generation education technology products made up of comprehensive school-specific software delivered at scale to large numbers of schools and groups operating across diverse contexts and environments; and
 - Third or "next" generation education technology products – generally those launched after 2020 and developed natively in the cloud to fully realise the benefits of cloud technology, design innovation and deep understanding of school-specific needs and challenges.
- 2. The history of education software evolution and how this evolution shapes the choices facing school leaders today including:**
 - The role of "Vertical" and "Horizontal" SaaS products – how school-specific (vertical) software fits together with generic (horizontal) software in a school context today and into the future.
- 3. Key conclusions for school leaders in navigating advances in horizontal, vertical and multi-generation technology approaches to help schools plan and deploy the right technology ecosystem and best position themselves for the future.**

The changing technology landscape for schools

1. The changing technology landscape for schools

The use of digital technology in schools has been growing steadily over recent decades which is consistent with trends in the wider community. As a result, education technology spending is rapidly growing in absolute terms and as a proportion of overall education expenditure and is expected to reach:

- **\$404 billion USD by 2025 – up from \$183 billion USD in 2019³**
- **Generating a Compound Annual Growth Rate of 16.3%**
- **Increasing from 3.1% of total education investment to 5.5%**

This is being driven in part by a relatively low starting point for technology investment in education compared with other sectors. In 2020 the “education and non-profits” sector was in sixth place for technology investment as a proportion of revenue behind:

- Banking and securities – 10.14%
- Technology and telecommunications – 7.05%
- Business and professional services – 5.71%
- Insurance – 5.58%
- Health care services – 5.31%
- Education and non-profits – 3.7%⁴

Covid-19 has significantly escalated technology utilisation in schools in response to remote learning and remote working challenges. This is likely contributing to growth in education technology investment, with one German study concluding that IT, telecommunications, health, social work and education organisations were the most likely to have sped up technology investment during the pandemic⁵.

It is highly likely that the ongoing effects of the pandemic will continue to drive and shape technology investment in the short term. Gartner's recent “top trends in K-12 education” all reflect pressure points exacerbated during the pandemic and which are likely to drive technology-aided responses including:

- Learning insight and analytics;
- Student and staff wellbeing;
- Adaptive learning;
- Growth of AI in education; and
- Ongoing cybersecurity threats from ransomware attacks⁶.

School leaders are also confronting technology changes happening around them. Education is the leading sector for unauthorised use of new technologies – known as “shadow IT” – including cloud-based productivity and storage products⁷. Staff, parents and students are increasingly using and expecting high-performance devices, operating systems and apps in every part of their day-to-day lives – and they are bringing these expectations to their interactions with schools. Together these forces are creating pressure on schools to meet higher and higher functionality and user experience standards within an increasingly diverse and complex technology environment.

³ Global EdTech market to reach \$404B by 2025 - 16.3% CAGR. (holoniq.com)

⁴ COVID-19 and technology investments | Deloitte Insights

⁵ COVID-19: how much have firms increased digital investments? | World Economic Forum (weforum.org)

⁶ 2023-gartner-top-strategic-technology-trends-k12education-ebook.pdf (gcom.cloud)

⁷ Shadow IT is real: 1 in 2 employees use unauthorized file services in order to get their job done. (knowbe4.com)

1.1. Core school operating systems

Within this environment, school leaders are first and foremost responsible for selecting and deploying the core operating systems their schools depend on. While devices, apps and services in personal and shadow IT worlds can be selected by individuals on a piecemeal basis, core operating software generally requires every user in a school to adopt a new system together in order for those systems to operate effectively.

These core ed-tech systems have traditionally been broken down into two main categories: School Management Systems (SMS) and Learning Management Systems (LMS). These software products power each school's daily operations based on a common standard of data structure, data integrity and data use governed by centrally controlled permissions and policies.

Changing school management systems and learning management systems is therefore particularly challenging. Identifying the right systems, system configuration, data migration, data cleansing, staff training and IT maintenance requires significant investment of time, human resources and capital. Often these systems are designed to automate and replace essential and familiar human workflows and processes – making the transition from known practices to new ones a significant risk during the adoption period. Moving from one established system to another is equally challenging as each system has unique strengths and capabilities.

The complexities of any transition away from existing products, the prevalence of shadow IT products and systems, and high expectations from staff, parents and students create significant risk for school leaders in selecting core education technology systems. Given the time, complexity and expense of changing these systems, school leaders today are placing a premium on de-risking IT decision-making processes in three key areas:

- Choice – making sure they have the right mix of technology components for each school's circumstances;
- Future planning – understanding when and how they need to prepare for any future transition; and
- Change management – ensuring they have the right strategy, timing, resources, processes and skills in place to manage any future transition.

1.2. Education technology evolution

Core education technology systems have undergone rapid and significant growth in their capability and in their adoption by schools over recent decades. The evolution of these products has been shaped in part by their various starting points, which in turn shape their strengths and capabilities. Given this impact it is useful to understand the different starting points and evolution paths of today's core school operating systems.

1.2.1. School Management System evolution

For the most part, early digital education technology developed in what we now understand as the School Management System category.

Beginning with small, locally developed point-solution software in the 1980s and 1990s, much of this early development began as basic accounting software designed by individual school staff with an IT interest. Based on their initial successes, these early tools evolved well beyond their initial scope.

Many of these systems followed natural workflows within schools, moving into the central record database area and aspiring to become a single source of truth for each school's community members. Reflecting the day-to-day reality of schools, these systems subsequently expanded to support communications with community members around financial transactions, personal/student information and school notifications.

Local compliance obligations have similarly shaped this evolution in many parts of the world – including driving system development beyond community record management and toward the classroom. Basic attendance management, pastoral care records and academic reporting capability have become increasingly common.

Today, many school management systems combine a single source of truth central record system with community communications and information sharing, basic timetabling, financial reporting, HR, payroll, notifications and permissions, student health and medical data, basic attendance capture and reporting, basic marksbook and academic reporting, activities, peripatetic staff management and a plethora of other functionalities specifically required by schools. How each system balances and delivers these various functions reflects their respective starting points and evolution.

1.2.2. Learning Management System evolution

Many of the LMS products used in schools today did not begin as products designed specifically for schools.

A number had their origin in the higher education sector – designed as software to digitise delivery of lecture-based instruction. These products were subsequently reshaped toward meeting broader K-12 classroom needs in addition to basic content management and delivery. Over time, developers have attempted to shape these products to the more rigid curriculum and syllabus requirements of K-12 education – as well as following day-to-day teacher workflows to address more complex learning and wellbeing requirements including:

- Higher-frequency informal assessments and observations;
- Student wellbeing and engagement data capture and use;
- Ongoing feedback between teachers and students – incorporating each student's own voice; and
- Deeper parent engagement.

In contrast, a number of school-specific Learning Management Systems evolved to augment pre-existing SMS products. These are generally divided into two categories:

- Systems designed as a “skin” interface for existing SMS software; and
- Purpose-built products designed specifically to support teachers in their learning and wellbeing work whose needs were not being met by basic SMS classroom functionality.

With a specific focus on the K-12 classroom, a number of these systems emerged to support teachers in their basic daily functions, including capturing:

- Attendance;
- Grades; and
- Pastoral care records.

Over time these systems evolved from a basic record system into tools for supporting academic and wellbeing reporting, with support for related teaching and learning workflows. Some LMS have also evolved toward supporting teacher planning – including collaborative curriculum, syllabus, unit and lesson planning infrastructure.

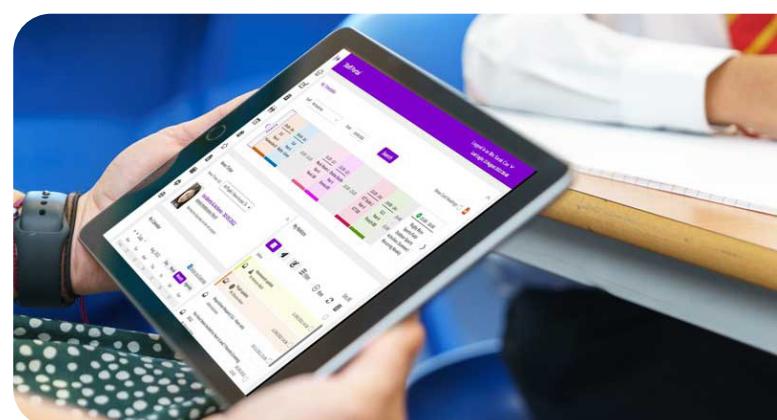
These different origin points significantly shape current LMS capabilities.

Tools created to support content management and delivery, for example, tend to have limited capacity to support teachers' learning and wellbeing work. Systems designed as a skin for existing SMS software tend to be constrained in the depth and rigour of data they can capture and use – based on the underlying limitations of the SMS software they support.

Similarly, more rigorous classroom focused LMS options can be constrained in their ability to integrate with SMS software, given the greater depth and complexity of data required by teachers compared to school administrative staff.

Attendance data management is an example of these challenges. Many School Management Systems evolved to support basic attendance data reporting – including for compliance. As a foundation these systems are built to compile attendance data by daily presence/absence at school, and in some instances have evolved to capture basic attendance/absence by class.

Learning Management Systems designed as a skin interface for these systems are limited to capturing only this basic attendance data. In contrast, some LMS products designed specifically to support teachers allow “minute-by-minute” attendance capture. This helps identify more rigorous and nuanced attendance trends – such as patterns of lateness for specific classes at specific times and connecting nuanced attendance data to student wellbeing and learning progression. Translating this data back into an SMS designed for basic attendance reporting can be complicated which reinforces the different strengths of systems designed as purpose-built teacher support tools compared to those designed as an interface skin for SMS products.





1.3. Overall take-away for school leaders – core ed-tech evolution

School leaders should understand how the origin and evolution of core school operating systems shape their respective strengths.

Each SMS product in market today takes a slightly different approach to balancing the wide range of functionality they share in common, including central records management, community communications, planning, finance and school operations management. Similarly, LMS product strengths differ between those designed originally for the higher

education sector and those designed specifically for K-12 schools. Among LMS products created specifically for schools, there are further differences between those created as standalone teacher support systems and those designed to be a skin interface for an existing SMS.

Understanding how these different origins and evolution pathways impact the respective strengths of contemporary SMS and LMS products is an important starting point for school leaders in navigating complex education technology decision-making.



Three generations of core ed-tech development

2. Three generations of core ed-tech development

The overall evolution and capabilities of core school operating systems can further be understood in terms of three distinct generations of education technology approach, defined by their respective technology-mix, design approach and performance.



- A loose mix of generic software tools, including email, spreadsheets and electronic documents.
- Ongoing manual creation, handling and storage of physical (paper) records.
- Bespoke or "homegrown" systems developed for an individual school or education system.



- Rich feature sets – supporting most school needs and processes.
- Often developed initially for an individual school or education system but then replatformed and rearchitected for broader utilisation.
- Suited for large number of schools across diverse operating environments.



- Emerging next generation technology.
- Made up of cloud-native Software as a Service (SaaS) platforms - capturing the full benefits of modern cloud environments.
- Allows for technology advances including multi-tenant, micro-services and API-first models.



2.1. First generation core ed-tech

The first generation of digital education technology approaches is generally made up of some combination of three elements:

- A loose mix of generic software tools including email, spreadsheets and electronic documents;
- Ongoing manual creation, handling and storage of physical (paper) records; and
- In some instances, bespoke or "homegrown" systems developed for an individual school or education system.

The defining feature of first generation core education technology approaches is the complexity of integrating their various elements into a coherent school operating system based around a single source of truth.

This includes integrating different software tools with human/manual processes operating at the school.

In many instances where schools rely on first generation technology approaches, basic digital data capture and storage operates alongside physical or manual records management. These processes generally involve extensive double-handling of data and rely on generic email and document creation tools (Microsoft; Google Suite) – which were not designed specifically for schools.

In some instances first generation approaches include purpose-built software designed for a single school or system. Functionality for these homegrown or bespoke products tends to be limited, and database design approaches make it difficult to map and manage the whole school community.. As these systems were not designed as commercial products for broad uptake by schools, they generally rely on their original technology platform, architecture and design. As a result, these early-stage bespoke software tools have faced difficulty expanding their breadth and depth of functionality in line with evolving school needs.

The ongoing reliance among these first generation approaches on generic email, spreadsheet and document creation – alongside physical file systems – makes it difficult for schools to maintain a single source of truth for their community.

Importantly, first generation approaches including early stage bespoke systems were never designed for the rigours of modern cyber security, making them increasingly vulnerable to human error and advancing cyber attack threats. Total cost of ownership for these approaches is likely to grow significantly as bespoke systems age and the cost and complexity of supporting them increases – including through ongoing reliance on a small number of expert system knowledge-holders.

Strengths:

There are limited strengths in first generation core education technology approaches. Overwhelmingly these benefits are based around familiarity with the processes, tools and products being used.

While these products still operate in some schools today, most schools have transitioned to second generation software products with greater utility and comprehensive feature breadth and depth and that are supported by greater ease of operation, ownership and integration.



2.2. Second generation core ed-tech

Most second generation core ed-tech systems are defined by rich feature sets that support a broad range of school needs and processes within a single system. While approaches vary, these broad features generally work around a single source of truth database model designed to ensure different aspects of each school's operations, data capture, data storage and communications align to one core set of records.

Alongside their rich feature sets, second generation systems have been developed specifically for adoption by large numbers of schools – which can be understood as the “productization” of this education software. While many current second generation school management systems originated as bespoke tools developed for an individual school or system, significant investment was deployed to re-platform and re-architect these products as they evolved into comprehensive SMS products. This investment has driven both the expansion of school-specific features and ongoing improvements in design, user-experience, security and integration. These second generation systems make up the significant bulk of core operating systems in use in schools today. The underlying architecture of these second generation systems has often been extended to allow for cloud hosting, ensuring their comprehensive feature sets and proven performance are retained while delivering improved cost of ownership and ongoing improvements in security and user experience. Ongoing improvement in API endpoint layers is also further driving integration capability across these systems.

Strengths:

By starting their lives in schools and evolving rich feature sets to support core day-to-day school needs, these products are uniquely suited to address the specific challenges schools face. Examples of these unique challenges are discussed in the following section of this whitepaper, which explores the place of “vertical” and “horizontal” software products in the school context.

Familiarity with these comprehensive systems is a further significant benefit. The school processes operating around core ed-tech systems represent a major investment of time and human resources over many years. Many of these systems have been highly configured – if not customised – to suit the needs and workflows of individual schools. Staff working with these systems understand how data moves through them and they are familiar with the human processes required to make them effective. As a result, the capture, storage, sharing, review, analysis and reporting of information through these established systems is often highly efficient. Transition away from these systems therefore involves significant cost, complexity and risk in terms of the human and technical processes required to replicate their functionality and familiarity in a new system.

Ongoing investment in security, user experience and cloud hosting ensures second generation systems can continue to support unique school-specific needs long into the future. Providers of second generation software are and will be heavily motivated to retain customers and ensure the longevity of their products for the long term (at least the next decade).

As discussed in the following section, improvements in horizontal software (generic software designed for all sectors, not specifically for schools) will continue – but these improvements are unlikely to fully meet many of the unique needs schools face in discharging their responsibilities to students and families. As a result, the proven performance, school-specific breadth and depth, improving functionality, security and user experience of second generation school-specific products will continue to serve schools over the next decade and beyond.



2.3. Third generation core ed-tech

The next, or third, generation of core ed-tech software is only beginning to emerge in market today.

This third generation of school operating software is made up of products designed specifically in and for the cloud – described as cloud-native⁸ Software as a Service (SaaS) platforms which are positioned to realise the full benefits of modern cloud environments. Their underlying architecture allows them to leverage significant technology advances including multi-tenant, micro-services and API-first models – allowing for fundamental compartmentalisation and scalability of each component of the software.

From a security perspective these products have been designed from the outset to leverage all the benefits of modern cloud service providers including Network Firewalls, DDoS mitigation, End to End encryption, database level encryption, identity and access control, security monitoring and logging as well as automated threat detection.

Security by design is a critical feature of third generation technologies allowing for authentication through Single Sign On (SSO) and Multi-Factor Authentication (MFA) as standard, scheduled penetration testing, continual learning platforms, secure removal of PII data, granular and role-based permissions as well as security certification as standard.

In terms of software design more broadly, these products work within the cloud to re-imagine school workflows and support more modern, intuitive interfaces with higher responsiveness across all devices. Typical database approaches are Postgres or equivalent and modern underlying architecture and design support hundreds of releases per month with a very low change failure rate. Once established, third generation products will leverage this capability to reliably grow, improve and adapt far more rapidly than previous generations of technology.

In terms of integrations these products are being designed and built with an API-first approach – providing 100 per cent coverage across the software based on an open-platform model. Importantly, an API-first approach supports both efficient internal development of the software as well as its capacity to integrate with external third-party products, allowing third generation software to sit at the heart of each school's technology ecosystem.

Beyond these technical characteristics, third generation education technologies offer a unique opportunity to leverage and implement design approaches reflecting many lessons learned from the last four decades of education technology development.

"Cloud native technologies empower organizations to build and run scalable applications in modern, dynamic environments such as public, private, and hybrid clouds. Containers, service meshes, microservices, immutable infrastructure, and declarative APIs exemplify this approach. These techniques enable loosely coupled systems that are resilient, manageable, and observable. Combined with robust automation, they allow engineers to make high-impact changes frequently and predictably with minimal toil.".⁸

"Next generation" technology evolution

While third generation school operating systems represent the future for education technology, they will take some time to become standard in the sector. This reflects a consistent pattern across most areas of technological change – where generational technology shifts routinely take more than a decade to fully manifest.

Telecommunications network technology is a good example. A full decade elapsed between the launch of 2G networks in 1991 and the first 3G network in 2001. The next generation 4G networks arrived 10 years later followed by the more recent launch of 5G networks in 2018-19 – which are anticipated to deliver revolutionary data capacity across cloud services and the broader "Internet of Things".

⁸ <https://github.com/cncf/foundation/blob/main/charter.md>.

Importantly, despite regular launches of new generation network technology every decade or so since 1991, 2G networks continue to operate and serve customers around the world today. And despite the presence of 5G networks in many countries, full utilisation of 5G capacity remains broadly unrealised. According to one commentator, "... though the potential (of 5G) is huge, and in some senses the technological leaps are inevitable, widespread take-up of 5G may still be somewhat 'in the future'. And with 4G coverage in excess of 80 per cent in most countries, and forecast to reach over 90 per cent by 2025, 4G is likely to remain the dominant mobile technology for now."⁹

The same pattern plays out in the business operating software space with both gradual uptake of next generation products and a "long-tail" for existing technologies over an extended transition period.

The Windows XP operating system from Microsoft launched in 2001. Despite the launch of Windows 10 in 2010, Windows XP continued to be used up until 2022 – over two decades after its launch. This example is especially important given Microsoft's significant investment in low-friction user upgrades.

Hardware and devices represent a useful third example. The first "smartphone" was developed by IBM in 1992 followed by multiple iterations prior to the emergence of the first iPhone in 2007. American smartphone penetration did not achieve 50 per cent until 2013 and took another four years to reach 80 per cent of users.

Given the feature-rich nature of second generation core ed-tech operating systems, full industry transition to the next, or third generation of core ed-tech operating systems will take a similar decade-long time frame – underpinned by ongoing investment in existing technologies over this period.

Strengths:

The important benefits for schools offered by third generation education technologies can be divided into three categories:

- Cloud benefits;
- Ed-tech lessons from the last four decades; and
- Usability benefits through design innovation.

Cloud benefits

Products designed in and for the cloud deliver unparalleled flexibility, scalability, low total cost of ownership, improved reliability and availability, faster deployment and iteration supporting increased innovation over time.

Ed-tech lessons from the last four decades

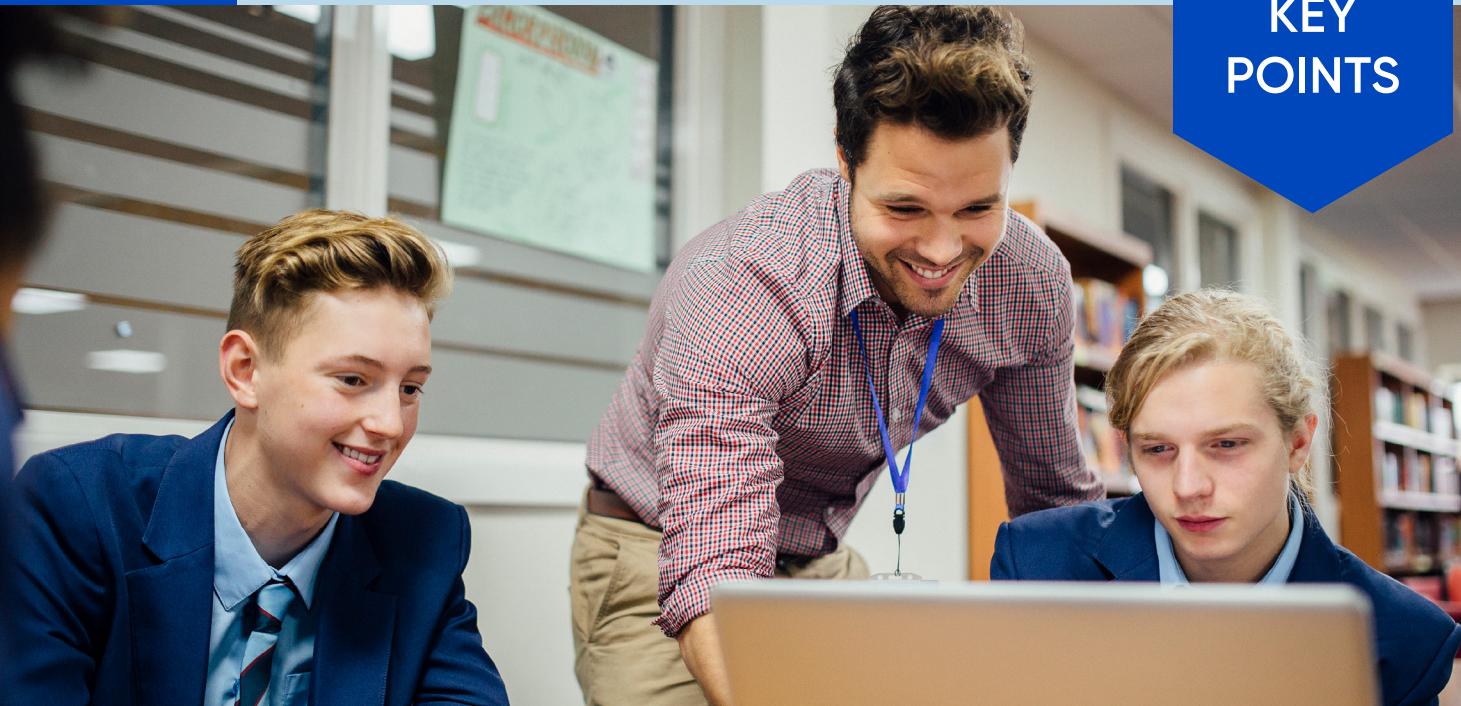
Building on decades of ed-tech experience, third generation products are purpose-built to support the information workflows and tasks supported by second generation products. Newly architected third generation products allow potential to deliver improved user experiences and workflows – including through an API-first approach. This has potential to make well understood day-to-day school tasks faster and easier while also supporting new functionality for schools in the future.

Design innovation benefits

The lessons learned from decades of ed-tech evolution have influenced the third category of benefits available to third generation products: design innovation. The API-first approach available in third generation software ensures different parts of that software can communicate with each other via an efficient back-end functional logic – making data capture and output increasingly flexible for schools. Similarly, third party integrations will ultimately be smoother, easier and offer greater flexibility over time as schools refine their long-term technology ecosystems. This is important for both the growing range of school-specific "point solution" software designed to meet a specific school need, and for leveraging generic software designed for all sectors which is the subject of the next section of this whitepaper.

Third generation core operating systems are only beginning to emerge and are continuing to develop functional breadth and depth as they move through their early stages of product development. Their underlying architecture, cloud-native origins and innovative design approaches support leading-edge intuitive interfaces, workflows and user experiences. This foundation in turn allows third generation systems to evolve and expand their functionality through continuous user feedback – reflecting their original design intention.

⁹ Why 5G may be taking longer than we thought – Arup



2.4. Overall take-away for school leaders – three generations of core ed-tech approaches

Schools relying on first generation bespoke and mixed generic/manual education technology approaches face a range of limitations, risks and cost which significantly outweigh any familiarity benefits of these approaches. School leaders should be actively exploring transition to newer generation school-specific core operating technologies as soon as practicable including emerging third generation software options.

For schools currently using comprehensive, school-specific second generation operating systems, the cost, complexity and risks associated with transitioning away from these systems is significant. For many schools, the comprehensive school-specific nature of these products, and their integration with established human processes, mean these products will remain the best solution available today. Ongoing investment in security, cloud hosting and user experience continues to extend the lives of these products well into the 2030s – allowing schools to prioritise getting the most out of these systems. This ensures second generation software providers will continue to focus on retaining customers and ensuring their products continue to perform for the long term (at least the next decade).

With the right, well-implemented and correctly configured second generation software in place, schools are also well positioned to take a considered planning approach to transition to future generation technologies.

Ultimately third generation ed-tech systems will become the norm for schools over the next decade and beyond which is consistent with the pattern of generational technology change in most sectors and areas. Early adopter schools can leverage the important advantages of these systems today by making this transition sooner, based on their school's specific needs.

School leaders should therefore be assessing their current, most critical school needs and technology functions against the evolving capability of third generation options. Where these needs show close alignment to the current and developing capabilities of third generation products, the immediate and longer-term benefits of third generation systems deserve active consideration. This is particularly the case for schools currently relying on first generation technology approaches.

Many schools today will be best served by continuing to work to get the most out of their proven second generation systems while monitoring the evolution of emerging third generation technologies. Continued investment in these second generation systems also gives schools the time and space to plan how any future transition will meet their needs, according to their own schedule.

An important element of this forward planning and consideration will be the evolving place of generic, or non-school-specific software in each school's future technology ecosystem. This last question is the subject of the next section of this paper.

A large, abstract graphic element consisting of overlapping blue circles and rectangles, creating a sense of depth and motion.

**Vertical and
horizontal
software**

3. Vertical and horizontal software

3.1. Horizontal SaaS

Many of the world's best-known software systems have grown their user-base and reputation by focusing on the common needs of the maximum number of users across the maximum number of sectors.

The companies delivering these systems have specifically designed them to be sector-agnostic, in order to maximise customer numbers and revenue – but are increasingly offering these systems with surface-level industry-specific "packs" or configurations. In their third generation form, these products are known in the technology industry as "horizontal SaaS" with a focus on serving basic needs in sectors where business functions are not particularly specialised.

Examples of horizontal SaaS products include the Microsoft and Google suites (including document creation, spreadsheets, file-sharing, communications and storage software) which operate in almost every part of our professional lives. Many businesses also rely on Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP) tools such as Salesforce, Netsuite and Microsoft Dynamics. Other examples of this type of horizontal software include products targeted to specific business functions – but which are relevant to all sectors – such as communications platforms (Slack, Zoom, Teams) and accounting software (Xero, MYOB, Sage, Quickbooks) alongside many others.

3.2. Vertical SaaS

Horizontal software products have always existed alongside and competed with sector specific, or "vertical" software designed to meet the specialised business needs of individual sectors. The third generation of these sector-specific software platforms are beginning to emerge across a number of sectors.

The companies developing these vertical SaaS products focus on

"Creating software solutions that are niche-specific ... Vertical SaaS companies zero in on specific need(s) and develop a product to fulfil that need of that specific industry. Vertical SaaS solutions are built by industry experts who have years of insights into industry specific problems and how to solve them".¹⁰

According to industry theory, rapid growth in Horizontal SaaS products has led the first wave of global SaaS disruption, generating significant growth in investment, sales and users. Following the rise of these generic products, "the second wave of disruption in enterprise cloud computing will come from vertical players who are creating purpose-built, vertically sliced tools."¹¹

A number of recent examples have emerged in specific industries. Public listings by Blend (Financial Services), Procore (Construction), and Toast (Food Service) underscore the significant impact vertical SaaS is having today. According to one vertical SaaS market analysis, "... total market cap (of vertical SaaS companies) increased from \$178.9 billion in March 2020 to \$441.4 billion at the end of Q3 2021."¹² Despite the smaller overall market potential of these products compared to larger horizontal systems, the investment community is directing significant resources toward these companies as more sectors recognise that only purpose-built, sector-specific software can meet their requirements.

¹⁰ What is Vertical SaaS and Why It's the Future of SaaS? (saastitute.com)

¹¹ Vertical Software Continues Its March To Victory | Bowery Capital

¹² The State of Vertical SaaS (2021) – Fractal Software

Vertical and horizontal software

Horizontal software:

Meets common business needs eg: documents, email, spreadsheets.



Vertical software:

Meets specialised needs of an individual sector.

Examples of specialised functionality in K-12 education:

- Managing complex family relationships, and the flow-on requirements for billing, safeguarding, and communications.
- Supporting student wellbeing.
- Maximising student learning progress.
- Compliance reporting.

3.3. Vertical SaaS and the education sector

As school operating software has evolved over the last four decades it has become increasingly clear that schools require software built to meet needs that are unique to the K-12 education context.

At the same time, schools do share some pain points and needs in common with other sectors. Future technology planning and investment for schools will likely include some horizontal SaaS products alongside their core vertical SaaS operating systems. This is particularly important as schools continue to grapple with the myth of a "one-stop-shop" single software solution for their schools. School leaders today need to carefully assess and understand the right mix of vertical and horizontal options to identify a sustainable balance and mitigate the risk of technology spread over time.

To find that right balance, school leaders should begin by exploring their particular needs in detail, against the different capabilities of vertical and horizontal software options. This includes areas where school needs are likely to remain unmet by horizontal SaaS products.

There are many examples of these unique areas of need for schools including parent engagement, medical information and care management, extra-curricular activities and timetabling. Below we consider three areas which are particularly challenging and unique to schools:

- Family relationships – including managing duty of care and complex fees and billing;
- Student wellbeing and engagement; and
- Student learning progress.

3.3.1. Family relationships

Schools are unique places in part because they take direct responsibility for the safety, wellbeing and development of young people on behalf of their parents and guardians. This responsibility significantly shapes the obligations, accountabilities and procedures governing every school.

School communities are overwhelmingly made up of families – with often complex relationships and networks within and beyond the school community.

In response, school management system providers have been required to develop record management systems that are capable of recognising and acting on family connections within each school community.

Two school management areas in particular demonstrate this need:

- School fee billing and invoicing; and
- Duty of care to students.

School fee billing and invoicing

School fees and billing management is as complex as the families that make up each school community.

Often tuition fees will be split in complex and changing ways across a wide group of immediate and extended “family”. For example, a student may receive a partial discount because they are the second sibling to attend that school. That student and her sibling’s tuition fees might be shared between parents who have separated. Of these parents, one may share part of the cost with the children’s grandparents, while the other parent may share part of the cost with their employer.

At the same time, changes in family circumstances or need can often result in temporary adjustments to fees and billing, including adjusted payment schedules, distributions and amounts.

Despite rapid improvements in generic accounting and business management software, the sheer complexity of school fee billing and invoicing remains beyond the capability of these systems.

Duty of Care to students

Similarly, child custodial arrangements can be enormously complex and subject to rapid change.

Every school carries a fundamental duty of care to every student enrolled. Understanding who has legal authority to provide permissions, make decisions in an emergency or pick up a child from school may seem relatively straightforward. Yet in complex cases these basic questions can create significant challenges for school staff and leaders.

For example, a parent recently released from prison might have some form of court ordered restriction applying to them or be subject to an ongoing legal dispute over custody, yet still present at school to pick up their child. Real-time knowledge of complex family circumstances is not a common need in many sectors – but this knowledge is essential for school staff. While these may seem extreme cases, they are relevant to most schools and underscore the importance of recognising family relationships within each school’s core operating software.

Rapid evolution in the Customer Relationship Management software industry has benefitted many different businesses, including schools. However, the primary relationship driving these systems has always been between the “company” and the “customer”. Relationships between “customers”, or in this case students, parents and staff within a school community, are largely unsupported.

Accounting for the fundamentally relational nature of each school community, and the multiple changing roles that people perform over time, is a non-negotiable requirement for core school operating software.

Critical data architecture features including persistent, life-long user IDs covering multiple roles (parent, alumni, staff member), as well as built-in relationship mapping, will remain essential for school operating systems into the future.

3.3.2. Student wellbeing and engagement

In addition to mapping complex family relationships, schools are also required to support student wellbeing and engagement in ways that are unique to the sector.

Changing social norms, changing behaviours and changing family contexts have generated new types of pressures on young people and contributed to rising mental health and other wellbeing challenges. Today, most school leaders rate student and staff wellbeing as their number one priority¹³. The growth in increasingly complex wellbeing demands, accountability and specialist services presents another complex maze for school leaders.

For example, unlike most workplaces, schools are increasingly expected to interface directly with the health care sector to ensure school staff can provide appropriate first stage support, and then connect students to appropriate specialist services as required.

Data required and produced by specialist or clinical providers in turn needs to be stored and shared in strict conformity to a range of legal frameworks. Clinicians need to be able to access relevant data from each student's classroom and wider school experiences. Clinical insights and recommendations then need to be made available in appropriate circumstances to school staff, to shape the support provided to students at school.

There are a number of horizontal systems which focus on wellbeing and engagement. Pulse surveys, data storage, records management, analytics and workflow systems are growing in popularity and impact. However, horizontal wellbeing and engagement products have not been designed for and cannot address the breadth and complexity of student wellbeing and engagement needs which schools face.

3.3.3 Student learning progress

As discussed in our recent whitepaper¹⁴, the available evidence base strongly suggests that each student's wellbeing at school is shaped by and in turn shapes their learning experiences. Supporting both student wellbeing and learning requires schools to easily and efficiently capture, connect, surface, analyse and share data and insights about a wide range of each student's experiences.

To meet these needs, school operating software must align to the unique workflows and daily rhythms of staff, in order to capture and access this wide range of data points for each student. Numerical or letter grades are essential – as is standardised test data. However, teachers also need to be able to capture and access subjective observations, formative assessments, informal assessments and student voice.

The scope and complexity of data required to identify student learning progress, and shape constant teacher decision making, is unlikely to be met via any generic software system.

Student voice is a particular case in point. "Student voice" refers to the ability for a student to articulate and share their own experiences – including of their learning. For example, evidence consistently shows that students are significantly more likely to achieve at least 12 months of learning over a 12 month period when they are able to clearly articulate:

- Learning intentions – (where they are going);
- Success criteria and progress – (how they are progressing); and
- Understanding of teacher feedback – (what they should be focusing on next).

While all corporate environments could benefit from a similar approach to professional learning, this will always be a peripheral activity for most horizontal software customers. Software specifically designed to support this type of interaction between teachers and students will therefore remain essential for schools.

¹³ School Survey Report 2022 | Education Horizons

¹⁴ Learning & wellbeing in schools white paper | Education Horizons

3.4. The future role of horizontal SaaS in schools

Alongside the central role of vertical software in schools, there are a number of potential areas where horizontal SaaS could have a greater place in each school's future ed-tech stack.

3.4.1. General ledger vs. fees and billing

Rapid evolution in horizontal SaaS accounting software has benefitted businesses of all sizes. As prices have come down, intuitive and accessible accounting packages have become increasingly common for businesses in many sectors.

In the education sector many second generation school management systems were built around an initial accounting software model, and these have expanded to include many finance and accounting functions – from general ledger management to invoicing and billing.

While horizontal SaaS accounting products are unlikely to evolve to support complex school fees and billing, general ledger management capabilities and requirements are more common between schools and other sectors. Many schools today do prefer meeting these general ledger requirements within their vertical SMS – limiting their technology stack and avoiding further integrations.

As horizontal finance and accounting options continue to evolve however, schools may increasingly utilise them for general ledger management – subject to seamless integration with their vertical systems.



3.4.2. Learning communications and interactions

The impact of the pandemic has driven a shift to remote learning for schools around the world including transitioning teaching and learning to online environments. Many schools adapted to these pressures by connecting with students and sharing learning content through generic communications platforms including Zoom, Microsoft Teams and Google Suite. These underlying technologies became essential for businesses in all sectors during the pandemic and this shift is likely to remain following the pandemic.

Today we are seeing key LMS functions increasingly integrate with these horizontal communication platforms to augment the sharing, capturing, accessing, analysing and reporting of student learning and wellbeing data.

As horizontal communication software capabilities expand, there may emerge a new balance in the future where essential student learning and wellbeing tools are provided by vertical LMS products working alongside horizontal SaaS communication, sharing, and virtual interaction tools.



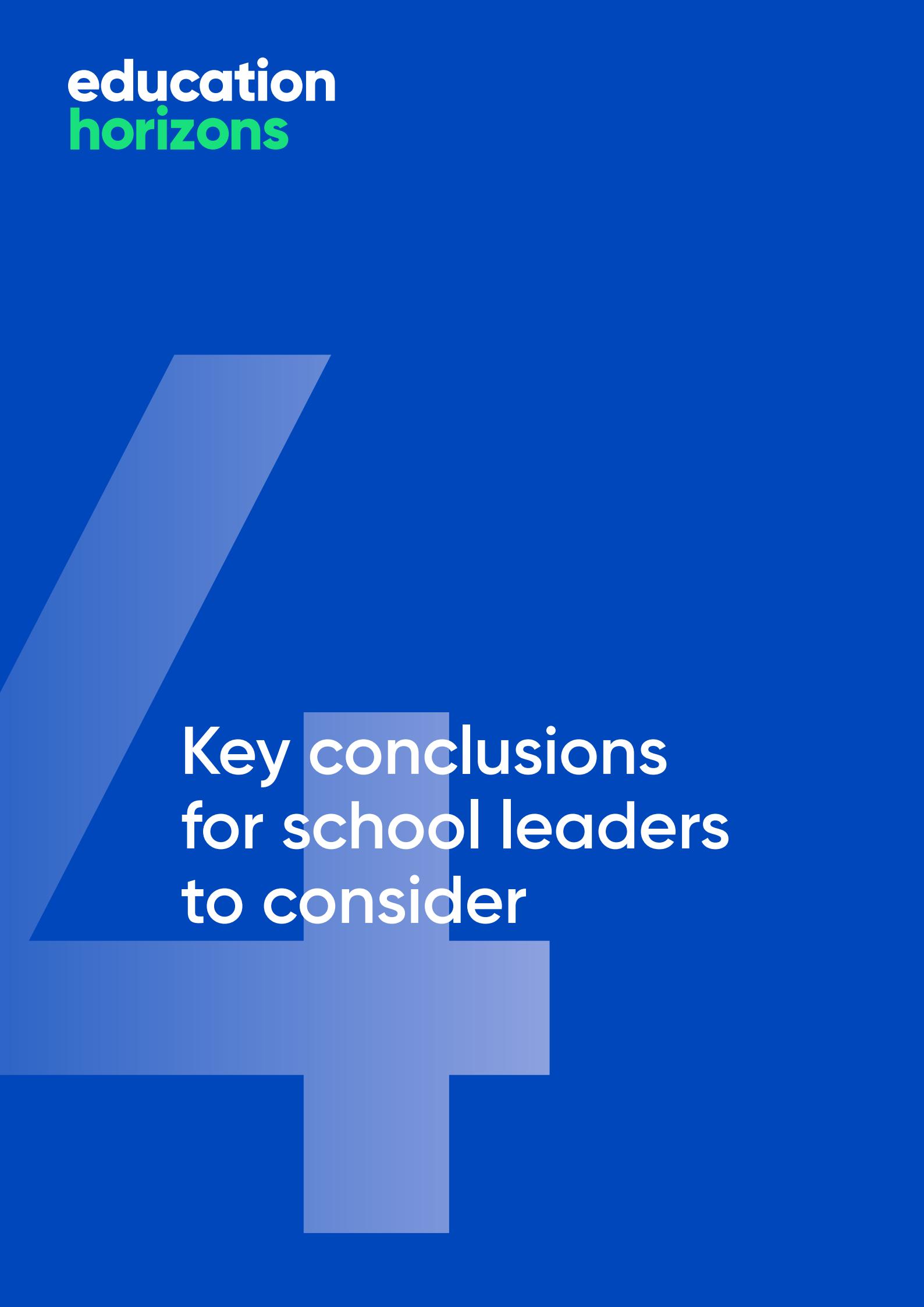
3.5. Overall take-away for school leaders – vertical and horizontal software

Like many sectors, K-12 schools are defined by a unique set of challenges and needs including:

- Managing complex family relationships;
- Supporting student wellbeing; and
- Maximising student learning progress.

Core operating software in schools must be able to support these challenges and needs, among many others. Horizontal software today is not designed to meet these challenges, despite ongoing development and progress in many areas where business needs are common across different sectors. Compared to the size of the generic business market, the relatively small size of the K-12 schools sector makes it unlikely that large horizontal software providers will justify investing in product development to meet these specialised needs. As in other sectors with similarly unique challenges and requirements, schools today and in the future will continue to rely on vertical operating software specifically designed to meet these challenges.

At the same time, there is space to explore changing roles for evolving horizontal software alongside core vertical systems, where school needs share more in common with other sectors – such as general ledger management and online communications. Many schools will continue to rely on comprehensive vertical software to deliver these functions within a single system in order to simplify their tech stack, limit integrations and maintain their current single source of truth. As schools navigate next-generation education technologies however, horizontal systems will be well-placed to augment each school's technology ecosystem based on the key principle of seamless integration with their vertical school operating software.



Key conclusions
for school leaders
to consider

4. Key conclusions for school leaders to consider

This whitepaper has sought to address the wide range of factors shaping each school's education technology planning and decision-making as they navigate ed-tech choices to maximise impact for their school.

We have summarised key conclusions from this paper to help school leaders as they continue this essential work:

- 1.** Education technology is increasingly becoming central to each school's ability to grow and deliver powerful learning, wellbeing and development experiences.
- 2.** All schools today should be on at least second generation core operating software which will help them avoid the risks, costs and limitations of first generation approaches (mix of homegrown, manual processes and spreadsheets/documents/email).
- 3.** For many schools the significant breadth, depth and familiarity of proven second generation software products present a highly efficient and effective solution for them today by allowing space to prioritise and invest now in getting the most value out of their existing software. Providers of second generation software are and will be heavily motivated to retain customers and ensure the longevity of their products for the long term (at least the next decade).
- 4.** The long-term future for schools will ultimately be third generation software designed specifically for schools, integrated with and augmented by appropriate horizontal software products.
- 5.** A growing number of schools are well-placed to transition to third generation education technology today, with potential to realise the benefits of these technologies sooner and help position their schools for the future.
- 6.** Overall transition to third generation education technologies will likely occur at an increasing rate over the next decade – reflecting experience in other sectors and technologies.
- 7.** All schools should use this time to begin engaging with and considering future transition to third generation technologies, at a time that suits them and their community.
- 8.** Despite rapid improvement, it is highly unlikely that horizontal software solutions will be able to meet all of the unique needs of K-12 schools. This makes them most effective when integrated with and working alongside core vertical school operating solutions.
- 9.** School leader planning should include clearly understanding the functional areas and workflows which demand uniquely school-specific vertical software to meet school needs – and those areas which can best leverage horizontal software products.

To discuss how these points and this whitepaper apply to your school, please reach out to one of our team at info@educationhorizons.com

For existing customers please contact your **Customer Success Manager** or our customer success team at customersuccessteam@educationhorizons.com

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Steve loves to work hard with people he admires, building teams to overcome tough challenges. With a background in software engineering, user experience design and digital product management, he comes to Education Horizons after stints at REA Group and Lonely Planet. He believes in the power of education to enrich people and communities and loves spending time with his three children, partner and friends. He has been the Chief Product Officer for Education Horizons since 2022.

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Mike has been the CTO at Education Horizons since early 2022. He brings to the team deep technical experience – with more than 20 years in product development covering software engineering and software architectures supporting both scaled SaaS software for millions of users and also on-premise, desktop deployment models for both small and medium enterprises. Mike is responsible for inspiring and growing the Education Horizons technology team, driving forward the technical vision for our business and ensuring frequent, quality delivery of product to our customers. Outside of work, Mike enjoys spending time with his family and is a passionate follower of many sports but especially basketball and Australian rules football.

For help and advice on your school's ed-tech strategy please contact us at
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