Planning for success: Enhancing teachers' confidence in innovation in schools

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ABSTRACT

Schools need to innovate to survive in a competitive and constantly evolving industry. This paper provides a new, simple way of thinking for educational leaders and teachers, to increase confidence in innovation projects, enable them to empower innovation in their schools, better justify innovation proposals and persuade other teachers to participate.

This case study shows how aspects of risk management and bow tie analysis can contribute to innovation activities. We show how the approach was applied successfully to the introduction of new classroom technology and collaborative learning in a secondary school.

The teacher uses six key questions, plus bow tie analysis, to structure and strengthen her innovation plan to make it more likely to succeed. This provides additional confidence to proceed, knowing that the innovation has been thought through carefully, advantages and disadvantages have been considered, and additional tasks have been included to improve the chance of success.

Keywords: innovation; innovation plan; innovation business case; enhancing teacher confidence; education technology; collaborative learning; secondary school; bow tie analysis; risk management; performance improvement; change management; case study.

PURPOSE OF THIS PAPER

This paper provides teachers and educational leaders with a process that can increase confidence in innovation projects and enable them to empower innovation in their schools. It describes simple tools to help them innovate more effectively and more confidently, strengthen their professional practice and improve learning outcomes.

The paper draws on tools from risk management, and particularly bow tie analysis, to describe a new way of thinking about innovation activities. A case study in a secondary school demonstrates how this approach was applied to a recent innovation associated with new classroom technology and collaborative learning.

While the approach is described in terms of innovation, it can also be applied to many other performance-improvement and change-management decisions.

RATIONALE

Schools operate in a fiercely competitive market and an evolving industry, usually with financial constraints. They need to innovate to improve educational outcomes and remain competitive.

Improved outcomes cannot be obtained by 'doing more of the same' – schools must innovate, to develop new ways of teaching and learning that deliver better results. Albury *et al*. (2016) echo this imperative: 'To realise the potential of all students, education systems must change what they do, creating new kinds of tasks, new ways of working, and new space for students to excel.'

As school leaders, we need to be confident in the way we make and implement innovation decisions. We need to encourage our schools and our teachers to take judicious risks that have been thought through carefully, so they make positive contributions to the school's strategic objectives and our students' learning. The tools described here will help in this.

Beyond individual projects, this paper illustrates how consistent risk-aware processes support a culture that embraces innovation that is purposeful, sustainable, and successful.

CHANGE AND INNOVATION IN EDUCATION

Innovation refers to anything that is new to the group involved. In teaching, innovation is most often associated with the introduction of information and communications technology (ICT), curriculum development or changes to teaching methods. This paper is concerned with the introduction of ICT in a classroom and the changes in teaching processes required to exploit the associated learning opportunities.

There are many external drivers of innovation in schools (Hannan *et al*, 1999; Serdyukov, 2017). They include:

- Increased government policy focus on standardised tests such as PISA (OECD, nd), and the importance for many stakeholders of school rankings based on test outcomes
- Resource constraints that require schools to do more with less
- Pressure from tertiary institutions for undergraduate entrants to be better prepared
- Pressure from employers for students to have more skills when they enter the workforce
- The need to improve student learning
- Curriculum changes
- Internal reorganisation
- Changes in student intake and student learning needs
- Changes in technology
- Changes in teaching practice due to emerging evidence and research.

Many authors have addressed school and university innovation in the form of technology change, which is recognised as a core aspect of modern education. For example, Ertmer and Ottenbreit-Leftwich (2010) state that 'effective teaching requires effective technology use'. Citing Fullan and Stiegelbauer (1991), they identify four areas in which teachers must change if technology innovation is to be successful:

1. Beliefs, attitudes and pedagogical ideologies
2. Content knowledge
3. Pedagogical knowledge of instructional practices, strategies, methods and approaches
4. Novel or altered instructional resources, technology and materials.

Focusing on teachers as the central agents of change, they explore necessary characteristics or qualities of teachers to enable them to leverage ICT resources as meaningful pedagogical tools. They recommend teacher change in pre-service education and in-service professional development across four topics: knowledge and skills, self-efficacy (confidence), pedagogical beliefs, and school and subject culture. All their recommendations relate to specific actions influencing knowledge, beliefs and culture.

These are all valuable suggestions, for which they provide highly persuasive arguments, but it is notable that none involves using risk management processes to increase teachers' confidence by improving either their understanding of potential problems and pitfalls associated with innovative or their planning for dealing with them. In this paper we show that appropriately applied risk management processes can augment recommendations like those of Ertmer and Ottenbreit-Leftwich (2010).

Many authors explicitly discuss factors that influence educational innovation and change, barriers to change and how to overcome them (Albion, 2015; Aust *et al*, 2005; Bruggeman *et al*, 2021; de Koster *et al*, 2017; Ertmer, 1999, 20057; Ertmer *et al*, 2012; Hannon, 2009; Hennessy et al, 2005; Holmes *et al*, 2013; Howard, 2013; Howard and Gigliotti, 2015; Howard and Mozejko, 2015; Lim *et al*, 2013; Loeste *et al*, 2021; López, 2010; Ma'arop and Embi, 2016; Mirzajani *et al*, 2015; Mueller *et al*, 2008; Rahmat, 2020; Rubia-Avi, 2023; Serdyukov, 2017, Straub, 2009; Tan and McWilliam, 2008; Wong *et al*, 2008; Zhao and Frank, 2003). 'Innovation is difficult to spread across school and academia because it disrupts the established routine and pushes implementers out of their comfort zone ... Teachers and school administrators are commonly cautious about a threatening change and have little tolerance for the uncertainty that any major innovation causes' (Serdyukov, 2017).

Ertmer (1999) distinguishes between classes of enablers and barriers. First-order enablers and barriers are usually related to the organisational context rather than the teacher:

- A school and subject culture that supports innovation, including strong senior leadership support, a shared group vision across the school, and openness to change
- Resources and infrastructure to make innovation feasible, often in the face of limited budgets and competing priorities
- Access to and use of suitable technology
- Technical and pedagogical support for teachers who want to innovate, including ICT support and teacher professional development.

Second-order enablers and barriers are usually internal to the teacher:

- Teachers' experience and pedagogical beliefs about good teaching practice

- Teachers' and students' knowledge and understanding of technology, and of which technologies and practices enhance learning outcomes

- Teachers' confidence in using technology, and in overcoming technical problems while teaching

- Teachers' openness to change, and willingness to spend time and effort to try something different.

In the school referenced in this paper, 25 years after Ertmer (1999), there are few first-order technology constraints. Institutionally, there is sufficient technology available, both hardware and software, and good ICT support. Most teachers are familiar with the proposed technology, although they may not have used it in a classroom setting. The main barriers are teachers' uncertainty, and hence confidence, about how they and their students can integrate the technology in their classroom practice and activities, and whether they can achieve better learning outcomes.

ROLE OF RISK MANAGEMENT

Good risk management involves the development and implementation of policies, frameworks and processes for understanding and dealing with uncertainty and its impacts on objectives. Its purpose is to create value and improve outcomes by exploiting and enhancing opportunities, reducing and avoiding threats, and making better decisions. Processes for risk management were formalised in English in the Australian and New Zealand Standard AS/NZS 4360 (Standards Australia, 1994) and are now part of an international standard ISO 31000 (International Organization for Standardization, 2018).

Risk management has been applied in the education sector for many years. High level policies, frameworks and processes address the risks faced by educational organisations (for example: Deloitte, 2018; PwC, 2023; TAFE NSW, 2024; University of California, nd; University of Cambridge, nd). Another strong thread uses risk management as a contributor to organisational governance and quality management (for example: Bailey *et al*, 2011; Bazaluk *et al*, 2024; Gallagher, 2013; NSW Government, 2021; Queensland Government, 2021; Talbot *et al*, 2014; TEQSA, 2019). There are many targeted applications associated with specific activities conducted by schools such as camps and excursions that might affect the safety and welfare of students and teachers (for example: International Organization for Standardization, 2024; Parkin and Blades, 1998; Queensland Government, 2021; University of Newcastle, nd).

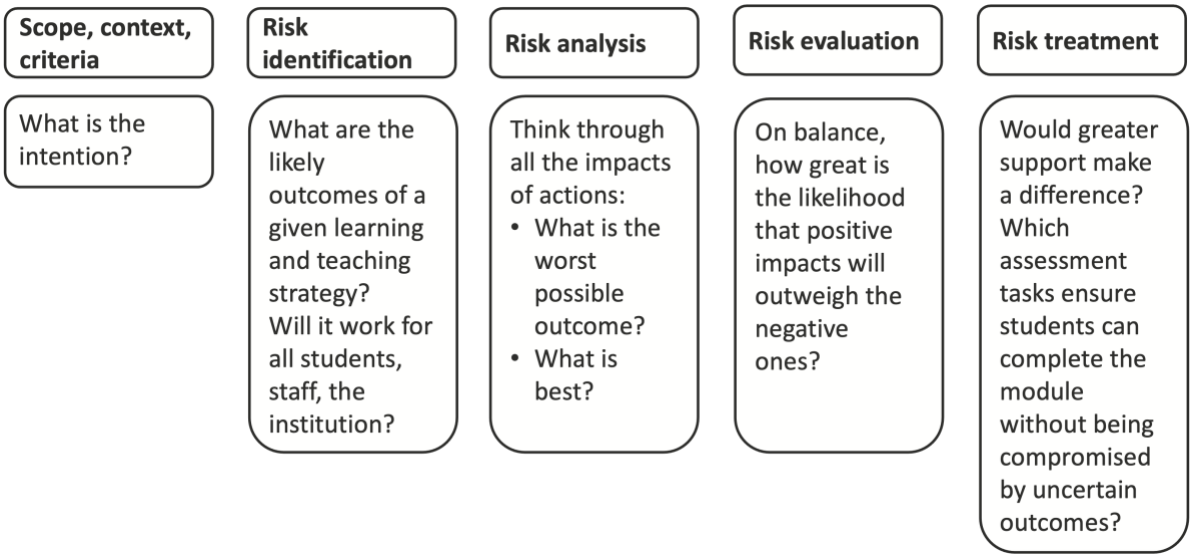
IEC 31010 lists many approaches to support the steps in risk management implementation (International Electrotechnical Commission, 2019), but only a few of them appear to have been applied in education. Table I lists some examples. This is a large gap we set out to address.

Table I: Techniques from risk management used in education

Technique	Focus	References
Bow tie analysis	Improving quality management in higher education	Bazaluk *et al*, 2024
Decision trees	Enhancing creative learning and teaching strategies	Hargreaves (2008)
Decision trees	Explaining the drivers for school students' engagement with technology innovation	Tan and McWilliam (2008)
Systems dynamics model	Better understanding of technology integration in schools	Howard and Thomson (2015)
Root cause analysis, incident reporting	Generating improvements by learning from successes and failures	Jemeljanenko and Mackeviča (2019), Schechter *et al* (2004)

Hargreaves (2008) discusses creativity and innovation in higher education, noting that creativity can be a source of risk for students and staff and a generator of ethical tensions. She discusses how risks were managed in case study examples and describes how decision trees, a recognised risk assessment technique (International Electrotechnical Commission, 2019), could be used 'to weigh up risks, minimise potential negative consequences and guide defensible ethical decisions'. The way Hargreaves interprets the development of a decision tree and the questions she asks, in the lower boxes in Figure 1, fit neatly into the steps of the international standard ISO 31000 (International Organization for Standardization, 2018) in the upper boxes.

Figure 1: A risk management interpretation of Hargreaves' questions (2008)



Howard and Thomson (2015) develop a systems dynamics model to explore the factors influencing teachers' integration of ICT in their teaching practice, with the aim of providing a way to better understand and support both technology integration and associated changes in teaching strategies.

Schechter *et al* (2004) discuss the value of learning from past school experiences as a way of generating positive impacts. They note that effort is traditionally focussed on problems and

failures, and they point out the many opportunities and benefits that can be obtained by examining past successes and good outcomes.

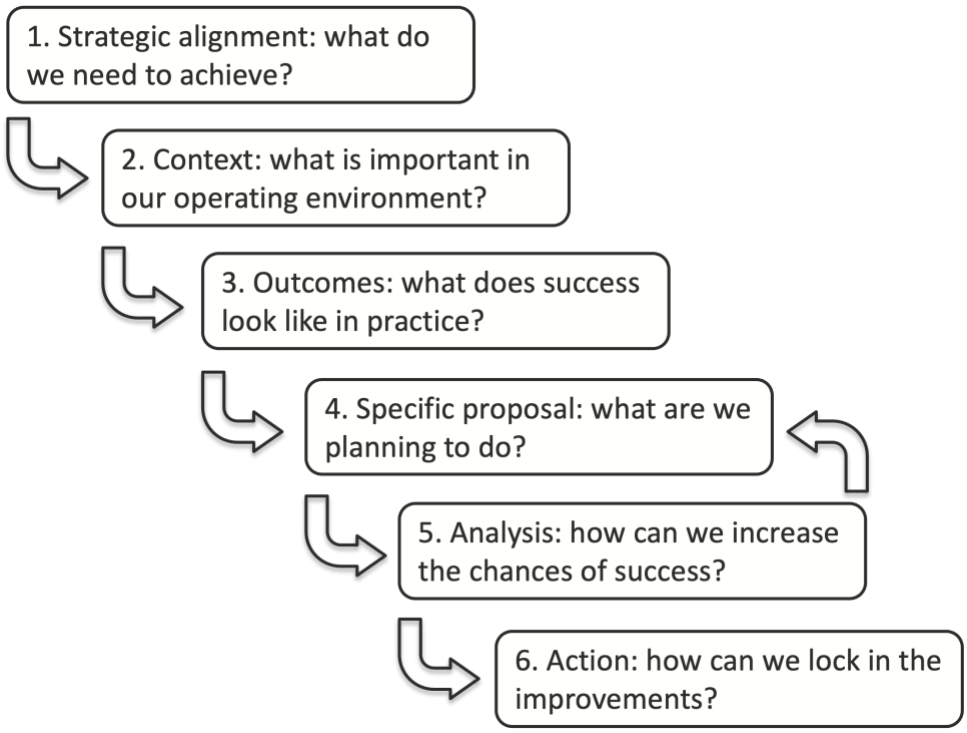
Our focus in this paper is a specific risk management tool: bow tie analysis. Bow tie analysis has traditionally been used to address hazards in the context of industrial safety (de Ruijter and Guldenmund, 2016), but it has wide application (for example, McLeod and Bowie, 2018). It is a technique for analysing threats and opportunities and associated controls, often called 'barriers' in a safety context. Its purpose is to develop a detailed understanding of what might happen, and then improve the control environment to reduce threats and enhance opportunities.

Like most risk-related tools, bow ties have both direct and indirect effects. The direct effects are specific improvements associated with addressing identified gaps or weaknesses. In an organisational context involving innovation and change, indirect effects are often at least as important: the thinking and analysis when creating a bow tie engender understanding, which leads both to improved confidence for teachers and to a cultural shift that accepts innovation as non-threatening and recognises its value. In our case, teachers were closely involved in the process of generating the bow ties and the ensuing action plans, and they could see that important issues, as they perceived them, had been addressed, cultural factors that Townsend (2013) identified as important.

THE PROCESS: PRACTICAL QUESTIONS TO SUPPORT INNOVATION SUCCESS

Figure 2 outlines the practical questions required to justify and build support for innovation, while addressing potential pitfalls and generating better ways of doing things. Each step is described in more detail below, with a particular focus on the benefits that can be generated by a sound analysis. By asking themselves these questions, schools can create confidence in innovation and increase the likelihood of success.

Figure 2: Steps in the process



1. Strategic alignment: what do we need to achieve?

The strategic objectives for the school drive everything we do, including any innovation that is proposed. This ensures that whatever is done is relevant and useful, and enhances specific outcomes that are important to the school. If the innovation has only marginal relevance to strategic objectives – if it does not support student achievement or welfare, improve the efficiency or effectiveness of school systems, or contribute to the school's governance, reputation and finances – there is little point in pursuing it further.

It is also worth thinking about the stakeholders who might influence or be affected by the outcomes of the innovation. Their objectives should be documented clearly, as they form the base for many of the subsequent judgements about the advantages and disadvantages of the proposal and options associated with it. Table II shows a simple table for this.

2. Table II: Examples of stakeholders and objectives

Stakeholder	Objectives
School Board	Strengthen reputation; maintain sustainable finances
School leaders	Drive strategy; improve operational performance; lead curriculum and practice; enhance culture
Students	Improve performance in external testing
Teachers	Increase student collaboration; build student digital literacy
Parents	Enhance student engagement and academic achievement
ICT Department	Provide sustainable ICT support and ICT infrastructure spending
Local community	Produce work-ready graduates
…	

3. Context: what is important in our operating environment?

It is useful to consider the school's operating environment and the internal and external forces that enable or constrain innovation.

- External forces: regulatory frameworks and compliance; market forces such as enrolment and funding; and expectations of students, parents and the local community.

- Internal forces: the level of resourcing – people, equipment and money – available for innovation; workplace and learning cultures, processes and systems; and the school's attitude to change.

These forces can either empower or limit innovation, and enable new ideas. Importantly, it is the influence of these forces on attitudes toward innovation – not simply the capacity to innovate – that can have the most powerful impact.

Table III shows a simple table for recording key factors and their implications for the innovation. The factors are best described in terms of statements of facts, and the implications answer the question 'So what?' in relation to each.

Table III: Examples of external and internal factors

Factor	Implications ('So what?')
A nearby school has experimented with a similar proposal but has not achieved success	We can identify elements that supported or inhibited success, and leverage or mitigate them We can plan our innovation project in ways that reflect the lessons learned We have an opportunity to demonstrate to the community greater capability than a competitor school
Parents expect the school to be innovative and make good use of technology	We must be seen to be innovating in worthwhile ways ICT-related innovations will be supported positively
The school has ICT licenses for collaboration software	Existing licenses reduce the financial cost of innovation and the financial exposure of failure
…	

4. Outcomes: what does success look like?

The alignment between the outcomes of an innovation and the school's strategic objectives frames the purpose of the activities we undertake, just as the environment in which we must operate frames how we go about their implementation. We need to consider these two aspects to develop a view of what successful outcomes might look like in a practical sense.

Describing the end-states of success and failure, and clarifying how to identify and measure them, ensures a common understanding of potential innovation outcomes. A sound description of success provides a base for evaluating the causes of enhanced or reduced success, the positive and negative impacts of actions, and the efficacy of existing and proposed controls.

Knowing what success looks like during implementation helps to manage innovation towards success and away from failure. It also informs evaluation procedures that demonstrate the value of the innovation and justify the actions taken.

5. Specific proposal: what are we planning to do?

The specific proposal must be described and analysed clearly so a coherent business case can be developed. Much of the initial information will have been developed in the previous steps above, but the analysis that follows adds significant detail.

The business case should be structured to persuade at least two audiences the proposal is worthwhile, and there may be other stakeholders who should be considered too:

- The school executive needs a clear view of the benefits, expressed in terms of the school's objectives, and the disadvantages and costs, including teacher hours and financial implications, so it can approve the effort and resources for implementation.

- The teachers who are likely to use the new technology must understand the benefits for learning outcomes and for their own teaching practice, as well as how they can realise those benefits.

The business case should start with a clear statement of objectives and a simple description of what is involved. In particular, there should be a clear alignment between the intended outcomes of the proposal and the objectives of the school and the other stakeholders, particularly the teachers who will be involved as users.

Much of the detail about the advantages and disadvantages will be developed in the next step, analysis.

6. Analysis: how can we increase the chances of success?

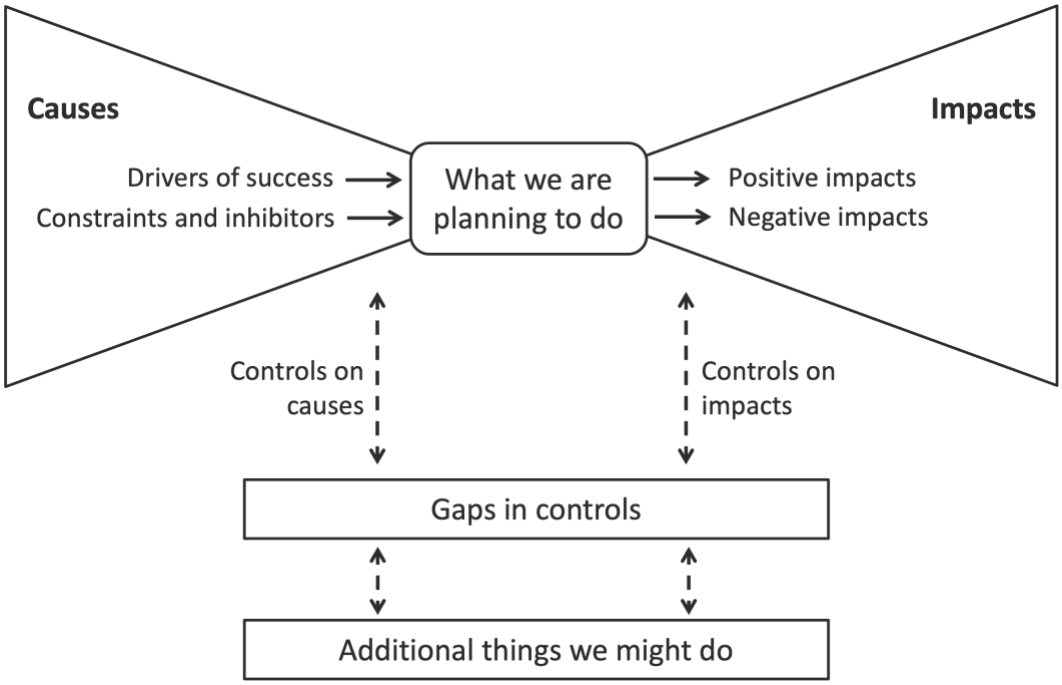
Structured analysis allows us to construct a precise understanding of all the forces that influence the innovation, and to consider and shape the ways we leverage or mitigate them. Purposeful analysis provides the detail for an implementation plan that builds confidence to proceed. The analysis is structured here around bow ties, a technique borrowed from risk management.

Bow-tie analysis

Bow tie analysis provides a way of structuring our thinking about what we might do. The process is illustrated in Figure 3 and described in detail below. In summary:

1. What we are planning to do sits at the centre of the bow tie
2. On the left are the factors that might enhance or limit the chance of success of the innovation, the causes
3. On the right are the factors that might enhance or limit the outcomes that might arise, the impacts
4. Within this structure, we can now describe the existing controls that might support the causes of success and improved outcomes or reduce the negative causes or outcomes
5. If there are gaps – causes or impacts that do not have matching controls – those gaps provide a focus for thinking about additional things we might do, either to enhance our chance and degree of success or reduce our chance of not fully achieving the outcomes we want.

Figure 3: Bow tie structure



Causes: what might enhance or limit the chance of success?

Identifying the main causes, and the controls already in place to manage these causes, provides visibility and understanding of necessary precursors for success. These are the conditions and inputs that will make the proposal work – or not – and our response to them.

Analysing causes identifies tangible points of leverage: either to maximise the likelihood and scale of success, or to minimise the likelihood and scale of failure. These provide an understanding of the likelihood of success of the innovation.

Impacts: what are the outcomes that might arise?

Identifying the main impacts, and the controls already in place to maximise beneficial impacts and minimise negative impacts, provides an understanding of the consequences of the innovation. We should consider the impacts of success or failure on core aspects of the school, including educational outcomes, health and welfare, finance, systems, governance and reputation. Where appropriate, impacts on the objectives of other stakeholders should be included in the analysis too.

Controls: what modifies the causes and the impacts?

Controls, identified as part of the analysis of causes and impacts, allow us to shape known causes and impacts in ways that maximise both the likelihood of success and the scale of impacts. Some common controls are listed in Table IV. They are in three classes – related to causes, impacts or general – but many controls, particularly those in the general category, can have wide effects that influence both causes and impacts.

Table IV: Common controls in school-based innovation

Category	Control
Causes	Preparation and planning
Causes	Independent review of the innovation plan prior to implementation
Causes	Specialised training and mentoring of teachers on the specific innovation and its rationale
Impacts	Clearly articulated connections to the curriculum
Impacts	Explicit mechanisms for ongoing monitoring and evaluation
Impacts	Isolation of high stakes testing from impacts until proof of efficacy is obtained
General	Modelling and prototyping before full-scale implementation (fail fast to succeed quickly)
General	Environmental scanning and research: what has worked in other places and why?
General	Expert assistance: help from someone who has done something similar before
General	Consistent processes for innovation planning and approval
General	Collaborative planning, development, implementation and evaluation with key teacher and ICT stakeholders, and possibly with students
General	Community engagement for support, from teachers, students and parents

Gap analysis: What else could we do?

Ideally, all the causes on the left-hand side of the bow tie and impacts on the right-hand side should have matching controls. Taken together, these should enhance the chances of success and reduce the chances of failure.

Where there are gaps, then we should think about other controls to enhance the chance of success and the scale of that success, and what actions might improve planned outcomes and leverage unexpected events. If all the controls in Table IV are not in place, or in the plan, the list may provide a guide for additional things to examine.

Options that might generate improvements should be listed, and evaluated transparently. This usually involves:

1. Describing the option clearly
2. Identifying its advantages and disadvantages, with a particular focus on the school's strategic objectives
3. Evaluating the option and whether it is worth doing.

In most cases detailed quantification of benefits and costs is not needed. A simple triage is usually sufficient:

- Yes: all things considered, the option offers clear advantages for the school, the overall risk is within our appetite, and it is worth doing; implementation is recommended.

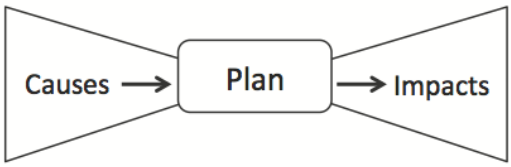
- No: the option would not add to student outcomes, or the overall risk exceeds our appetite, or it might be more appropriate to defer it for now.

- Maybe: the option looks reasonable, but more thinking and analysis is needed before a firm commitment can be made; the option might be deferred or more detailed analysis and evaluation might be recommended.

Several options might be selected for implementation, to enhance the success of the main innovation proposal.

Figure 4 shows a template that can be used for collecting information from the analysis and supporting the evaluation of options.

Figure 4: Evaluating options

<table>
<tr><td colspan="5">Innovation proposal description:
• Description of what is proposed, and what success looks like</td></tr>
<tr><td colspan="5">Bow tie:
 
</td></tr>
<tr><td colspan="2">List of causes:
1. Cause 1
2. …</td><td colspan="3">List of impacts:
1. Impacts 1
2. …</td></tr>
<tr><td colspan="2">List of controls relating to causes:
1. Cause control 1
2. …</td><td colspan="3">List of controls relating to impacts:
1. Impact control 1
2. …</td></tr>
<tr><td colspan="2">Gaps:
1. …</td><td colspan="3">Gaps:
1. …</td></tr>
<tr><td colspan="5">List of options to address gaps:</td></tr>
<tr><td>Option</td><td>Advantages</td><td>Disadvantages</td><td>Priority</td><td>Owner</td></tr>
<tr><td>1. Option 1</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2. Option 2</td><td></td><td></td><td></td><td></td></tr>
<tr><td>3. …</td><td></td><td></td><td></td><td></td></tr>
</table>

Enhancing the business case

Much of the detail developed in this analysis will be valuable for enhancing the business case initiated in step 4.

6. Actions: how can we lock in the improvements?

Unless something is done, the effort spent on analysis is wasted. We need to identify specific actions we will take, when, how and by whom, and then ensure they are implemented. Actions that maximise the success of the innovation form the basis for the implementation plan.

This stage, when planning and analysis is built into action, can benefit from additional input. It is often useful to engage a 'critical friend' to review the analysis and offer new perspectives. A critical friend is usually someone within the school who has not been involved in the planning to date (though, for larger projects, an independent external point of view may be useful). Swaffield (2003) describes a critical friend as, 'An outsider with a different perspective, who sees things through a different lens, acts as a mirror and a sounding board, and asks provocative questions, contributes essential elements to school self-evaluation.' The intent is not to change the focus of the project, but rather to provide fresh ideas and identify anything that may have been overlooked or not considered.

In every innovation where ideas, processes and activities new to the school are being implemented for the first time, there should be ongoing monitoring and evaluation. Initially this will ensure implementation proceeds smoothly; later it will confirm the innovation continues to deliver the promised benefits. Monitoring and evaluation should be informed by the strategic objectives and descriptions of success identified during planning. They should also include scans for unforeseen or emerging causes, impacts or control gaps.

The specific tasks and implementation plan should be part of the business case.

DEMONSTRATING THE PROCESS: DIGITAL COLLABORATION IN A SENIOR SCHOOL CLASSROOM

This section demonstrates how the process described above works in practice. It is based on a real case, presented in slightly less detailed form for clearer exposition. In the case, a teacher shapes an innovation project that aims to increase students' collaboration and digital skills while providing equitable access to learning for all children.

Overview

The teacher plans to create greater opportunities for students to collaborate in online environments. She intends to develop learning routines for online collaboration, install equipment that enables students to work together and make what they produce visible to the teacher, and make use of existing software licenses held by the school.

1. Strategic alignment: what do we need to achieve?

In a recent strategic review, the school identified the development of digital literacy skills and effective collaboration as key areas for improvement. Through observation, the teacher identified this as a need reflected in the students in her classes. By enabling collaboration in digital spaces, the infrastructure and associated processes for learning directly address these strategic goals.

2. Context: what is important in our operating environment?

Among many external forces that influence the project, the teacher identifies access to effective online collaborative tools and availability of grant funding as particularly significant. Existing tools will shape the learning routines she designs, and funding will enable a limited innovation project to be brought to prototype in her classroom.

The teacher also identifies many important internal forces that influence the project, including a willingness by the school leadership to support innovation and high levels of technical ICT expertise and support at the school. Strong leadership support has ensured there are existing processes for planning and approving innovation projects, and effective ICT support provides an opportunity for advice and technical efficacy.

3. Outcomes: what does success look like?

The teacher articulates a successful outcome as: 'Students collaborating effectively in a digital environment. Collaborative processes and work product are visible to the students and the teacher.'

4. Specific proposal: what are we planning to do?

The teacher is planning to install in her classroom three additional whiteboards and flat-screen televisions with connections for digital devices. The whiteboards will provide space for 'big picture' thinking that leverages face-to-face collaboration, and the screens will make the processes and products of digital collaboration visible for students and the teacher. Along with the existing projector and board, these will create spaces for students to work in four collaborative groups simultaneously.

The teacher will trial a range of online collaborative tools and learning processes. She will provide instruction on collaborative routines and software and engage in explicit discussions about the learning processes involved. She will do this with students and other teachers who use the classroom.

5. Analysis: how can we increase the chance of success?

The teacher develops a simple bow tie to help her analyse the project. This is shown as a diagram in Figure 5, but in practice she uses Table V. Note that much of the information in Table V would be sourced from earlier analyses in forms like Table II and Table III.

Figure 5: Bow tie for the collaboration case

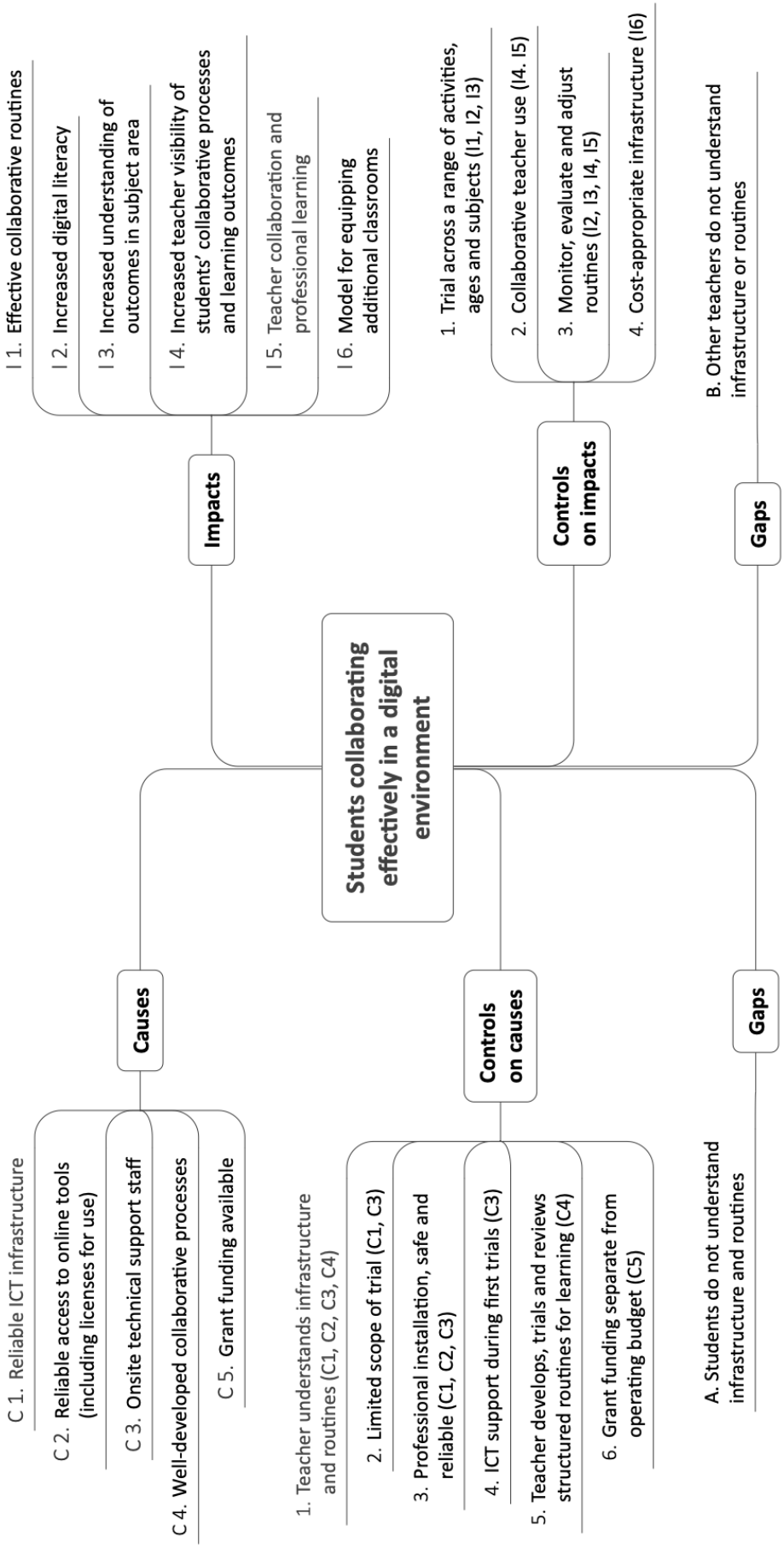


Table V: Analysis of the online collaboration case

Innovation proposal description:

Students collaborating effectively in a digital environment. Collaborative processes and work product are visible to the students and the teacher.

List of causes:	**List of impacts:**
C1. Reliable ICT infrastructure C2. Reliable access to online tools (including licenses for use) C3. Onsite technical support staff C4. Well-developed collaborative processes C5. Grant funding available	I1. More effective collaborative routines I2. Increased digital literacy I3. Increased understanding of outcomes in subject area I4. Increased teacher visibility of students' collaborative processes and learning outcomes I5. Improved teacher collaboration and professional learning I6. Model for equipping additional classrooms
List of controls relating to causes:	**List of controls relating to impacts:**
1. Teacher understands infrastructure and routines (C1, C2, C3, C4) 2. Limited scope of trial (C1, C3) 3. Professional installation, safe and reliable (C1, C2, C3) 4. ICT support during first trials (C3) 5. Teacher develops, trials and reviews structured routines for learning (C4) 6. Grant funding separate from operating budget (C5)	1. Trial across a range of activities, ages and subjects (I1, I2, I3) 2. Collaborative teacher use (I4, I5) 3. Monitor, evaluate and adjust routines (I2, I3, I4, I5) 4. Cost-appropriate infrastructure (I6)
Gaps:	**Gaps:**
A. Students do not understand infrastructure and routines	B. Other teachers do not understand infrastructure or routines

List of options to address gaps:

Option	**Advantages**	**Disadvantages**	**Priority**	**Owner**
1. Train students to use equipment and learning routines (Gap A)	Improved learning outcomes for students Students are already familiar with the technology	Requires re-allocation of class time	Worth doing now	Teacher

2. Train teachers to use equipment and learning routines (Gap B)	Improved learning outcomes for students	Teachers will have to be persuaded to participate Training will have to be included in the professional development schedule	Plan for next term	Teacher
3. Obtain and review teacher observations and critical feedback during lessons involving digital collaboration (Gap B)	Involve teachers in the project Initiate culture change	Teachers will have to be released from class (or use unallocated time) to observe	Invite teacher observers now	Teacher
4. Obtain and review student observations and feedback during lessons involving digital collaboration (Gap A)	Involve students in the project Reinforce students' critical thinking about their learning processes Initiate culture change	Minor disruption to learning activities	Worth doing now	Teacher

The analysis indicates there are already significant elements that support the success of the innovation. However, there are also two significant gaps – the existing understanding of infrastructure and learning routines by students and by teachers – that should be addressed to strengthen the likelihood of success and maximise the intended impacts. The gaps indicate the teacher can improve her implementation plan by enhancing familiarisation, training and evaluation processes for both student and teacher users of the equipment and the associated learning routines.

6. Action: how can we lock in the improvements?

The teacher identifies four key options to pursue. She develops the following actions to support the success of her project:

1. Limit the initial project scope to a prototype classroom to identify and resolve early implementation problems
2. Engage with on-site ICT experts during design and installation, and secure their support during early implementation
3. Develop purposeful routines for learning within the new technology environment now, for incorporation into professional development training for teachers in the next term
4. Develop explicit training on infrastructure and routines for learning for students and other teachers who will use the new technology
5. Prepare a plan and recording regime for ongoing monitoring and evaluation, including:
    a. Each teacher's own observations, reflections and evaluation
    b. Work samples
    c. Feedback from student users
    d. Critical observation and feedback by peers
    e. Usage data from ICT support

f. Collaborative evaluation with teacher users.

CASE STUDY OUTCOMES

Outcomes from the case study

During the innovation, the teacher evaluated the changes to the classroom environment and to teaching practice. She collected data on usage and perceptions, the number of activities and enquiries from peers, professional observation, and student performance. Her evaluation concluded there was a significant impact on teacher and student practice and perceptions.

She also concluded that it was likely there had been a positive impact on student performance, but she could not be confident about this without a more rigorous quantitative analysis.

As a result of the innovation she observed:

- Increased number, frequency and efficacy of learning activities that leveraged blended collaborative practice, measured by teacher registration of the learning activities that included blended collaboration

- Increased use of digital collaboration tools by students in and beyond classroom activities, measured by usage data from ICT applications that demonstrated increased amount and duration of user engagement

- Increased confidence and perceptions of value of digital and blended collaboration by students, measured through data collected in a student perception survey

- Increased interest by teachers in using ICT applications for collaboration, measured by the number of enquiries and informal lesson observations by colleagues, and formal requests from teachers and Subject Leaders to invest in similar infrastructure in other classrooms

- Increased student performance compared to previous cohorts, measured by internal assessments and external examinations; however, while these outcomes were clear and demonstrated by data, her evaluation was not able to conclusively determine whether this was either a direct or indirect result of the innovation.

These outcomes were sufficiently strong and sustained. They convinced the school Executive and Board to investigate – and ultimately invest in – a broad adoption across the school of the new classroom design that incorporated the infrastructure and applications for blended collaboration.

The lasting legacy of the case study

Due to the success of the innovation, the school began to implement this model of classroom design and blended collaborative practice more widely. This began by refurbishing nine additional classrooms used primarily by two subject departments. This allowed the

school to build a shared understanding of effective practice amongst teachers who already worked closely together, and experiment with ways of building consistent practice across classrooms.

This was followed by a strategic decision to incorporate the same blended collaboration spaces into all future refurbishments or new building of senior school classroom spaces. With the re-development of the junior school precinct, this model was incorporated in physical classroom environments and teacher practice across the school from K to 12.

The initial innovation project proved far more significant than expected initially. School leaders were able to use the success of the prototype to assure the Board that moving to scale:

1. Added value to teaching and learning practice and student outcomes
2. Was affordable and sustainable
3. Would be more likely to succeed by taking advantage of the lessons learned during prototype implementation and evaluation
4. Would be supported by teachers due to their shared experience and observation of success.

When they prepared their business case for implementing this innovation widely across the school, senior leaders used a bow tie analysis like the one described earlier. The prototype innovation and its success were a significant part of this.

LESSONS

Teachers tend to focus on the education aspect of education management. This paper has shown that tools from other management disciplines, risk management in this case, can be adapted for use in schools and simplified so that teachers can use them easily. Here the teacher used key questions and bow tie analysis to structure her planning. These enabled her to strengthen her innovation plan in ways that made it more likely to succeed.

The bow tie approach, and the associated steps in Figure 2, might look daunting at first for someone who does not have a background in this kind of analysis. In essence, though, all they do is provide a structure for thinking and asking relevant questions.

Because the process is simple and structured, it can be more than a stand-alone activity for a specific innovation. It can be generalised to any kind of proposal, so the thinking steps become part of 'the way we do things' rather than a one-off application.

The process can be scaled for larger or more complex proposals or to generate more sophisticated outcomes. The case here was relatively small and simple, so a simple approach was appropriate. The same steps could be undertaken in greater detail, with more iteration between them, for innovations that need larger investments of time, effort, money and commitment, or those that warrant more detailed change management.

In the specific case described here, outcomes from the prototype provided the foundation for a business case for extended implementation. They supported:

- A robust description of the advantages and disadvantages of the proposal

- A justification for additional activities to enhance its chances and degree of success
- Development of a set of detailed tasks and a plan for implementation.

An extension of the analysis, with slightly different but not dissimilar steps, could have been used to generate a formal analysis of the threats and opportunities (risks) associated with the proposal. In this form, the first four steps (strategy, context, outcomes and specific proposal) might be quite similar, but the analysis would be extended to include the identification, analysis and evaluation of risks. The bow tie approach could then be applied to each of the most significant risks, leading to actions that would improve outcomes. As in the simpler case here, the actions would be directed to increasing the likelihood and extent of beneficial outcomes and reducing the likelihood and extent of adverse impacts, using a form of the option list at the bottom of Table V.

Approaches like the one described here, and extensions to them, can provide additional confidence to proceed, knowing that the innovation has been thought through carefully, the advantages and disadvantages have been considered, and additional tasks have been included in the plan to improve the chance of success.

With a coherent and articulated structure for planning innovation in schools, teachers and educational leaders can follow a consistent process designed to maximise success. They have a focus and structure for working collaboratively to plan innovation, empowered by a commonly understood process. The use of a structured, proven process also provides teachers and leaders with the confidence that likely risks, causes, impacts, gaps, actions and outcomes have been identified, documented and understood.

A consistent innovation processes across the school support a coherent organisational culture that embraces innovation. With a structured approach that is understood and applied across innovation projects, leaders can leverage an innovation culture that is risk-aware – not risk-averse – and empower a greater propensity to take judicious risks that have been thought-through carefully. It is in this fertile ground that schools can shape the purposeful, progressive strategies that will enhance the school's strategic objectives and advance student learning.

In short, this process will ensure that innovation in schools works more purposefully, more successfully and more often.

CONFLICTS OF INTEREST

The first author is a teacher at the school where the case study took place. The authors are not aware of any conflicts of interest associated with this paper.

REFERENCES

Albion, P.R., Tondeur, J., Forkosh-Baruch, A. and Peeraer, J. (2015) Teachers professional development for ICT integration: Towards a reciprocal relationship between research and practice. *Education and Information Technologies*, Vol. 20, pp. 855-673.

Albury, D., Beresford, T., Caple, K. and Peterson, A. (2016). *Innovating for Global Excellence: Australia's education opportunity*. Innovation Unit and AISNSW Institute, Sydney.

Aust, R., Newberry, B., O'Brien, J. and Thomas, J. (2005) Learning generation: Fostering innovation with tomorrows teachers and technology. *Journal of Technology and Teacher Education*, Vol. 13, No. 2, pp. 167-195.

Bailey, S.J., Valkama, P., and Anttitoiko, A.-V. (2011) Failure of risk governance in public sector ICT-based innovations: Analysis and synthesis. *Journal of Risk and Governance*, Vol. 2, No. 3, pp. 159-172.

Bazaluk, O., Pavlychenko, A., Yavorska, O., Nesterova, O., Tsopa, V., Cheberiachko, S., Deryugin, O. and Lozynskyi, V. (2024) Improving the risk management process in quality management systems of higher education. *Scientific Reports*, Vol. 14, Article 3977.

Bruggeman, B., Tondeur, J., Struyven, K., Pynoo, B., Garone, A. and Vanslambrouck, S. (2021) Experts speaking: Crucial teacher attributes for implementing blended learning in higher education. *The Internet and Higher Education*, Vol. 48, Article 100772.

de Koster, S., Volman, M. and Kuiper, E. (2017) Concept-guided development of technology in 'traditional' and 'innovative' schools: quantitative and qualitative differences in technology integration. *Educational Technology Research and Development*, Vol. 65, pp.1325-1344.

de Ruijter, A. and Guldenmund, F. (2016) The bowtie method: A review. *Safety Science*, Vol. 88, pp. 211-218.

Deloitte (2018) Significant risks facing higher education: Taking an enterprise approach to risk management. Deloitte Development LLC. Available at https://www2.deloitte.com/us/en/pages/public-sector/articles/higher-education-issues-and-enterprise-risk-management.html, accessed 8 November 2025.

Donovan, J., Trimmer, K. and Flegg, N. (Editors) (2020) *Curriculum, Schooling and Applied Research: Challenges and Tensions for Researchers*. Palgrave Studies in Education Research Methods, Palgrave Macmillan, Cham, Switzerland.

Ertmer, P.A. (1999) Addressing first- and second-order barriers to change: strategies for technology integration. *Educational Technology Research and Development*, Vol. 47, No. 4, pp. 47-61.

Ertmer, P.A. (2005) Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development*, Vol. 53, No. 4, pp. 25-39.

Ertmer, P.A. and Ottenbreit-Leftwich, A.T. (2010) Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research and Technology in Education*, Vol. 42, No. 3, pp. 255-284.

Ertmer, P.A., Ottenbreit-Leftwich, A.T., Sadik, O., Sendurur, E. and Sendurur, P. (2012) Teacher beliefs and technology integration practices: A critical relationship. *Computers and Education*, Vol. 59, pp. 423-435.

Fullan, M. and Stiegelbauer, S. (1991) *The New Meaning of Educational Change*. Teachers College Press, NY.

Gallagher (2013) *Collaborative Risk Management: 'Risk Management' vs 'Managing Risk'*. Gallagher Higher Education Practice, Think Tank Report, Arthur J. Gallagher Risk Management Services.

Hannan, A., English, S. and Silver, H. (1999) Why innovate? Some preliminary findings from a research project on 'Innovations in Teach and Learning in Higher Education'. *Studies in Higher Education*, Vol. 24, No. 3, pp. 279-289.

Hannon, J. (2009) Breaking down online teaching: Innovation and resistance. *Australasian Journal of Educational Technology*, Vol. 25, No. 1, pp. 14-29.

Hargreaves, J. (2008) Risk: the ethics of a creative curriculum. *Innovations in Education and Teaching International*, Vol. 45, No. 3, pp. 227-234.

Hennessy, S., Ruthven, K. and Brindley, S. (2005) Teacher perspectives on integrating ICT into subject teaching: Commitment, constraints, caution, and change. *Curriculum Studies*, Vol. 37, No. 2, pp. 155-192.

Holmes, K., Bourke, S., Preston, G., Shaw, K. and Smith, M. (2013). Supporting innovation in teaching: what are the key contextual factors? *International Journal of Quantitative Research in Education*, Vol. 1, No. 1, pp. 85-102

Howard, S.K. (2013) Risk-aversion: Understanding teachers' resistance to technology integration. *Technology, Pedagogy and Education*, Vol. 22, No. 3, pp. 357-372.

Howard, S.K. and Gigliotti, A. (2015) Having a go: Looking at teachers' experience of risk-taking in technology integration. *Education and Information Technologies*, March 2015.

Howard, S.K. and Mozejko, A. (2015) Teachers: technology, change and resistance. In M Henderson and G Romero (Eds.) *Teaching and Digital Technologies: Big Issues and Critical Questions*, pp. 307-317. Cambridge University Press, Port Melbourne.

Howard, S.K. and Thomson, K. (2016) Seeing the system: Dynamics and complexity of technology integration in secondary schools. *Education and Information Technologies*, 21 (2016): 1877-1894.

International Electrotechnical Commission (2019) *IEC 31010:2019 Risk management – Risk assessment techniques*. 2nd edition, IEC, Geneva.

International Organization for Standardization (2018) *ISO 31000:2018 Risk management – Guidelines*. ISO, Geneva.

International Organization for Standardization (2024) *ISO 31031:2024 Managing risk for youth and school trips*. ISO, Geneva.

Jemeljanenko, A. and Mackeviča, L. (2019) Incident reporting in the educational sector in Latvia. *Proceedings, 'Human, Technologies and Quality of Education', 77th Scientific Conference of the University of Latvia*, pp. 53-61.

Lim, C.P., Zhao, Y., Tondeur, J., Chai, C.S. and Tsai, C.-C. (2013) Bridging the gap: Technology trends and use of technology in schools. *Educational Technology and Society*, Vol. 16, No. 2, pp. 59-68.

Loeste, J., Heidmets, M., Ley T. and Stepanova, J. (2021) Classroom innovation becoming sustainable: A study of technological innovation adoption by Estonian primary school teachers. *Interaction Design and Architecture(s) Journal*, Vol. 47, pp. 144-166.

Lopez, C. (2010) Moral responsibility and confidence as factors that influence teacher involvement in educational change. *PROFILE Issues in Teachers' Professional Development*, Vol. 12, No. 1, pp. 63-78.

Ma'arop, A.H. and Embi, M.A. (2016) Implementation of blended learning in higher learning institutions: A review of the literature. *International Education Studies*, Vol. 9, No. 3, pp. 41-52.

McLeod, R.W. and Bowie, P. (2018) Bowtie Analysis as a prospective risk assessment technique in primary healthcare. *Policy and Practice in Health and Safety*, Vol. 16, No. 2, pp. 177-193.

Mirzajani, H., Mahmud, R., Ayub, A.F.M. and Wong, S.L. (2015) Teachers' acceptance of ICT and its integration in the classroom. *Quality Assurance in Education*, Vol. 24, No. 1, pp. 26-40.

Mueller, J., Wood, E., Willoughby, T., Ross, C. and Specht, J. (2008) Identifying discriminating variables between teachers who fully integrate computers and teachers with limited integration. *Computers and Education*, Vol. 51, pp. 1523-1537.

New South Wales Government (2021) Non-Government Schools Not-For-*Profit Good Governance Principles Series*. Non-Government Schools Not-for-Profit Advisory Committee, New South Wales Government, July.

OECD (nd). Programme for International Student Assessment (PISA). Organisation for Economic Cooperation and Development, Paris. Available at https://www.oecd.org/en/about/programmes/pisa.html, accessed 8 November 2025.

Parkin, D. and Blades, G. (1998) Risk management and outdoor education: a practical approach to ensuring positive outcomes. HORIZONS, Vol. 66, pp. 10-15.

PwC (2023) Managing risk in higher education: Higher education sector risk profile 2023. PricewaterhouseCoopers LLC, London. Available at https://www.pwc.co.uk/government-public-sector/education/documents/higher-education-sector-risk-profile-2023.pdf, accessed 8 November 2025.

Queensland Government (2021) Enterprise risk management procedure. Version 7.4, Department of Education, Queensland Government. Available at https://ppr.qed.qld.gov.au/pp/enterprise-risk-management-procedure, accessed 8 November 2025.

Queensland Government (2024) Managing risks in school curriculum activities procedure. Version 6.4, Department of Education, Queensland Government. Available at https://ppr.qed.qld.gov.au/pp/managing-risks-in-school-curriculum-activities-procedure, accessed 8 November 2025.

Rahmat, N.H. (2020) Innovation in education: Barriers and facilitating factors. *European Journal of Education Studies*, Vol. 6, No. 10, pp. 55-65.

Rubia-Avi, B. (2023) The Research of Educational Innovation: Perspective and Strategies. *Education Sciences*, Vol. 13No. 1, p. 26.

Schechter, C., Sykes, I. and Rosenfeld, J. (2004) Learning from success: A leverage for transforming schools into learning communities. *Planning and Change*, Vol. 35, Nos. 3&4, pp.154-168.

Serdyukov, P. (2017) Innovation in education: what works, what doesn't and what to do about it? *Journal of Research in Innovative Teaching and Learning*, Vol. 10, No. 1, pp. 4-33.

Standards Australia (1994) *AS/NZS 4360:1994 Risk management*. Standards Australia, Sydney, and Standards New Zealand, Wellington.

Straub, E.T. (2009) Understanding technology adoption: Future directions for informal learning. *Review of Educational Research*, Vol. 79, No. 2, pp. 625-649.

Swaffield, S., with a contribution by J. Jones (2003) Critical friendship. inFORM number 3, October 2003, Leadership for Learning Network, Faculty of Education, University of Cambridge. Available at https://www.educ.cam.ac.uk/networks/lfl/about/inform/PDFs/InForm_3.pdf, accessed 8 November 2025.

TAFE NSW (2024) Enterprise risk management policy. PROJ17/53489, TAFE NSW, Sydney. Available at https://cd.tafensw.edu.au/api/-/media/Files/PDFs/Policies-and-Forms/TAFE-NSW-Enterprise-Risk-Management-Policy.pdf, accessed 8 November 2025.

Talbot, J., Perrin, D. and Meakin, D. (2014) Risk management and cultural virtue in HE co-delivery arrangements. *Quality Assurance in Education*, Vol. 22, No. 2, pp. 109-124.

Tan, J.P.-L. and McWilliam, E.L. (2008) Digital or diligent? Web 2.0's challenge to formal schooling. *Proceedings Australian Association for Research in Education (AARE) 2008 International Education Conference*, Brisbane.

TEQSA (2019) Risk assessment framework. Tertiary Education Quality and Standards Agency (TEQSA), Australian Government. Available at https://www.teqsa.gov.au/guides-

resourses/resources/corporate-publications/risk-assessment-framework, accessed 8 November 2025.

Tondeur, J., van Braak, J., Ertmer, P.A. and Ottenbreit-Leftwich, A.T. (2016) Understanding the relationship between teachers' pedagogical beliefs and technology use in education: a systematic review of qualitative evidence. *Educational Technology Research and Development*, Vol. 65, No. 3, pp. 555-575.

Townsend, W. (2013) Innovation and the perception of risk in the public sector. *International Journal of Organizational Innovation*, Vol. 5, No. 3, pp. 21-34.

University of California (nd) *Enterprise Risk and Resilience*. Office of the President, University of California. See https://www.ucop.edu/enterprise-risk-and-resilience/erm/index.html, accessed 8 November 2025.

University of Cambridge (nd) Risk management. Governance and Compliance Division, University of Cambridge. See https://www.governanceandcompliance.admin.cam.ac.uk/assurance-audit-regulatory-compliance/risk-management, accessed 8 November 2025.

University of Newcastle (nd) *Risk assessments for teaching and research*. University of Newcastle, Australia. Available at https://www.newcastle.edu.au/current-staff/teaching-and-research/health-and-safety-for-teaching-and-research/risk-assessments-for-teaching-and-research, accessed 8 November 2025.

Wong, E.M.L., Si, S.S.C., Choi, T.-H. and Lee, T.-N. (2008) Insights into innovative classroom practices with ICT Identifying the impetus for change. *Educational Technology and Society*, Vol. 11, No. 1, pp. 248-265.

Zhao, Y. and Frank, K.A. (2003) Factors affecting technology uses in schools: An ecological perspective. *American Educational Research Journal*, Vol. 40, No. 4, pp. 807-840.

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