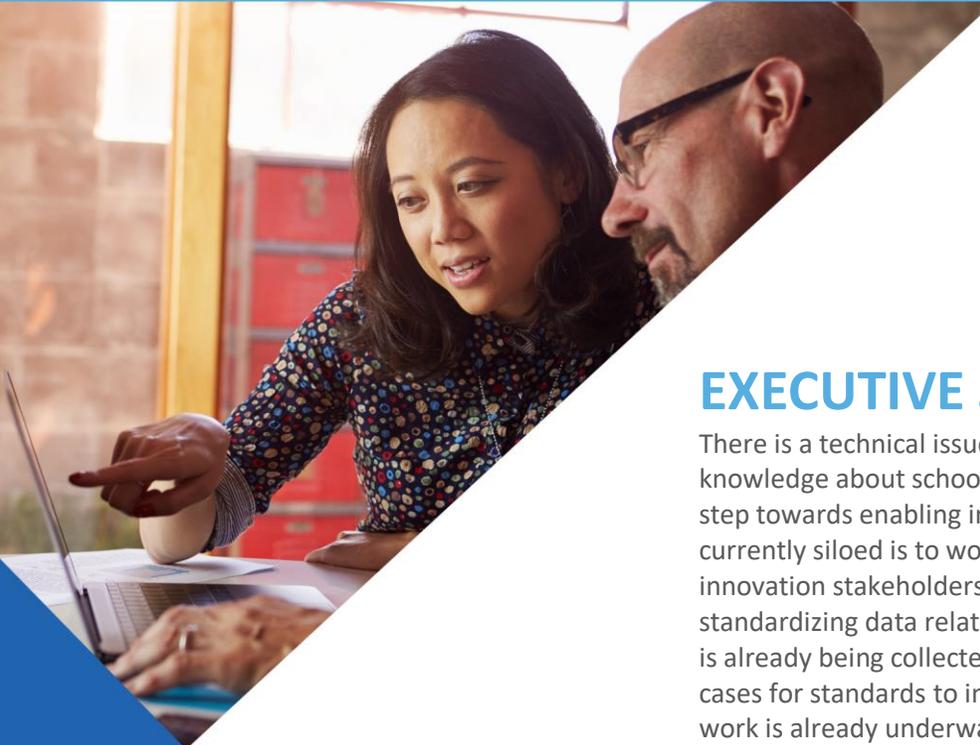# Standardizing School Innovation Data
Report and Recommendations

Jim Campbell and Nancy Copa
Developed by AEM Corp. in partnership with the Christensen Institute
October 1, 2019

EXECUTIVE SUMMARY

There is a technical issue at stake when it comes to improving collective knowledge about school innovation: data interoperability. The first step towards enabling interoperability between datasets that are currently siloed is to work to standardize the data itself. School innovation stakeholders should take concerted steps towards standardizing data related to innovative school design. Data of this type is already being collected and shared, meaning that there are clear use cases for standards to increase the coherence of that data. Definitional work is already underway for many concepts related to school design, but at varying degrees of maturity. In most cases, education data standards bodies are unaware of this definitional work and data collection efforts underway. This report urges school innovation funders, intermediaries, and researchers to engage more proactively with standards bodies to integrate school design concepts into existing standards to maximize adoption, rather than pursuing a new standard.

CONTENTS

I.   INTRODUCTION: The Fragmented State of Data on School Innovation

Educators across the country increasingly recognize the need to rethink learning models to better develop and prepare a new generation of leaders to face the complex challenges of the future. While a number of promising models and approaches are beginning to take root, reliable data on which schools are innovating, how, and to what end remains siloed and incomplete. In the Canopy project report[1], the Christensen Institute has described the broad parameters of this knowledge silo problem and its consequences on school innovation.

RELIABLE DATA ON WHICH SCHOOLS ARE INNOVATING, HOW, AND TO WHAT END REMAINS SILOED AND INCOMPLETE

Going a layer deeper, there is a technical issue at stake when it comes to improving shared knowledge about school innovation: data interoperability. A complete picture of school innovation will never come from a single data collection effort such as the Canopy project's crowdsourcing approach. Indeed, many leading organizations in the field are doing valuable work collecting and sharing data on promising innovative school models for the field to learn from. With some regularity, non-profit organizations, researchers, and funders build databases or maps to represent schools working to innovate. They also frequently engage in data-building activities that are less technically sophisticated but nevertheless rich in information that benefits the field, such as through landscape scans, lists of schools to visit, and case studies.

Ideally, these discrete efforts to highlight which schools are innovating, how, and to what end would be transparent and complementary in order to build on each other. Instead:
- Funders, intermediaries, and research organizations tend to collect information on schools based on their particular projects, interests, or philosophies, often using particular or even proprietary terminology that is not understood or defined consistently across the field;
- Data collection occurs in short cycles or on a project-by-project basis and is shared in inconsistent formats, yielding non-interoperable assets including closed, searchable databases; school lists; or data embedded in qualitative case studies and articles profiling schools;
- Non-publicly available outcomes data may be collected throughout some of these efforts as well, but it is rarely shared in a comparable or comprehensive way;
- As efforts aim to keep up with 'new' innovative approaches, 'old' data, descriptions and categories are replaced, limiting the potential for trend analysis over time.

The first step towards enabling interoperability between these valuable, but currently siloed, datasets is to work to standardize the data itself. This report describes what is meant by "data standards," analyzes the current Canopy tagging system in relation to data standards that already exist and lays out an argument for how to establish a well-defined data standard for

---

[1] https://www.christenseninstitute.org/canopy-project

school design. It concludes with recommendations for action among funders, intermediaries, and researchers.

Towards a more complete picture of school innovation: why standardization matters

Standards—mutually understood ways of defining different pieces of information, how they relate to each other, and how they're shared—would enable more comparable and cumulative data, and more efficient sharing, towards a better understanding of who's doing what in school innovation. Standards related to data on school design are currently inadequate or completely lacking. Building towards standardization would offer a structure for collaboration by enabling organizations developing and working with datasets to share and merge data in predictable and complementary ways and at greater scale, for example:
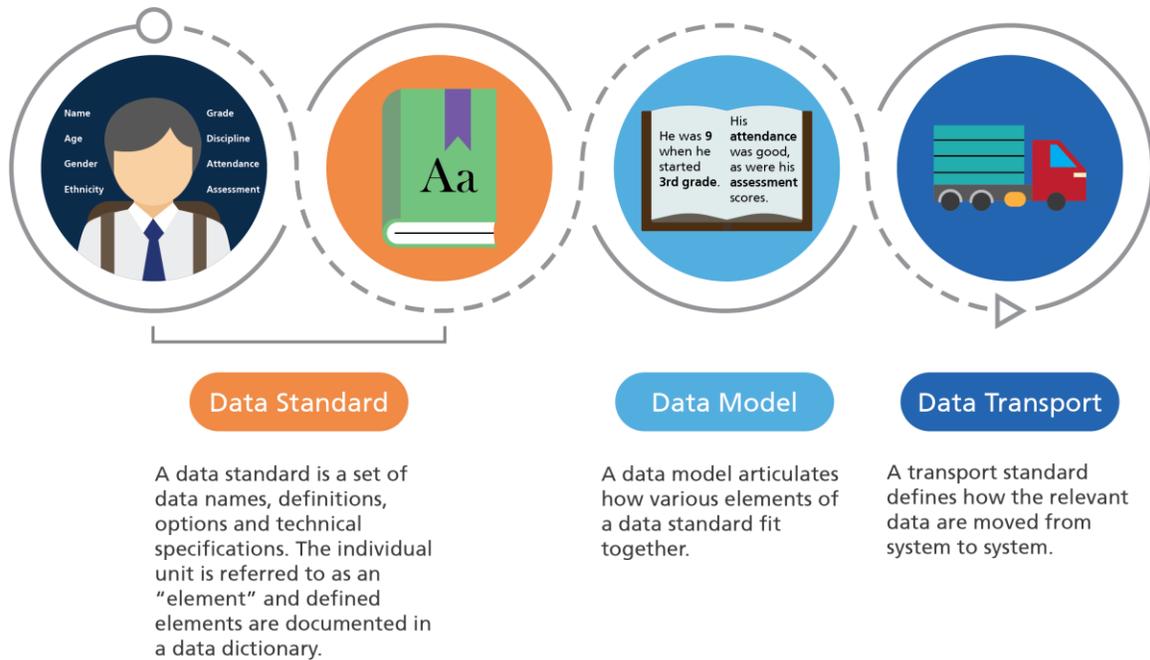
- Aggregating data from existing databases on innovation in schools, such as The Learning Accelerator, Blended Learning Universe, Education Reimagined, Digital Promise League of Innovative Schools, and more;
- Integrating innovative design information into public-facing data on schools, such as in GreatSchools; and
- Capturing school innovation data through regular data collection efforts at the county and state levels.

These potential scenarios require some degree of interoperability among datasets, which is enabled by data standards. Using data standards, stakeholders could collect and build information over time, rather than re-inventing a new snapshot of a school's current practices for each project. This would also more easily enable analysis of trends in school innovation based on many factors such as time, geography (state, rural, urban), school diversity (race, SES, migrant, homeless), or school structure (charter, public, private, magnet, Title I).

Without some form of standardized data, stakeholders managing school innovation data will have limited ability to pursue these broader opportunities. Ultimately, standardizing school design data would enable the year-over-year capture of a full and complete picture of how schools are reimagining the learning experience for students. This would dramatically increase the ability of reform advocates to accelerate innovation and scale impact so that every child has an education experience that prepares him or her to thrive.

II. WHERE TO BEGIN: Data Standards

In education context, the meaning of a "standard" can vary greatly. For instance, there are education standards associated with assessments, student information databases, and learning resources. For the purposes of this document, we will consider standards as they relate to a data dictionary, data model and data transport.

Data Standard

A data standard is a set of data names, definitions, options and technical specifications. The individual unit is referred to as an "element" and defined elements are documented in a data dictionary.

Data Model

A data model articulates how various elements of a data standard fit together.

Data Transport

A transport standard defines how the relevant data are moved from system to system.

Data Standard. A data standard is "an agreed upon set of data names, definitions, options and technical specifications."[2] The individual unit in a data standard is often referenced as an "element" and a set of defined elements are collectively documented in a data dictionary.

A data standard establishes a common language through which schools, states, researchers, parents, teachers and various education stakeholders are able to communicate. Data standards establish shared definitions for each element in order to empower greater transparency and sharing of data. For example, in the case of student data, creating a data standard for "first name" means that two organizations can maintain data on students and trust that "first name" means the same thing in each of their datasets.

Data Model. A data standard is most useful when the relationships between elements are described in a model.[3] Expanding on the data dictionary and going beyond simple lists of standardized elements, a data model begins to articulate how the various elements of a data

---

[2] Common Education Data Standards, 2019, https://ceds.ed.gov

[3] While not discussed in this report, three common types of models are conceptual, logical and physical. Conceptual models define high-level relationships, logical models expand these associations into greater detail and physical models define how the model is implemented technically (e.g., into a database).

standard fit together. Where a data standard might define what "gender" or "class assignment" or "first name" means, a data model begins to associate elements with each other. A student, for example, may include a conglomeration of elements including gender and first name to give the full picture. If the data standard is the dictionary, the data model puts all the words defined in the dictionary together in a structured, meaningful format to create a story.

Data Transport. A transport standard defines how the relevant data are moved across the "wire" from one system to another. Defining the specific protocols, templates and choreography associated with transport of data between systems, transport standards enable data integration and/or interoperability. If the data model is the structured assembly of elements in the dictionary into a story, the transport standard is the publisher that prints the book, puts it on a truck and delivers it to the local book store.

The data standards, data model, and transport standards do not exist in isolation and must build on each other. Establishing clear transport standards for the movement of data between systems without first defining the data standard and then the data model will result in ambiguous and disjointed data showing up on the doorstep of a trading partner, creating confusion at best and complete isolation at worst. The data standard must be defined first, followed by the model and lastly the transport.

A COMMON DATA DICTIONARY AND MODEL WOULD MEAN THAT ORGANIZATIONS BUILDING AND TRACKING INNOVATION IN SCHOOLS WOULD IDENTIFY CERTAIN KEY ELEMENTS OF SCHOOL DESIGN IN **COMMON, COMPARABLE** WAYS.

Developing these three types of standards for school innovation data—in this order—could significantly reduce the data fragmentation that is currently the norm. Using a common data dictionary and model would mean that organizations building and tracking innovation in schools would identify and document certain key elements of school design in common, comparable ways. A transport standard would enable organizations to share and integrate their data on school innovation in transparent, replicable, and efficient ways.

III. THE STANDARDIZATION PROCESS: Organic, Incremental and Dynamic

The school innovation field is dynamic, with cutting-edge designs continually emerging. The language and practice surrounding innovative school designs is still evolving, which may make it particularly difficult to imagine in the context of a data standard. However, it is important to emphasize that the development of data standards is an unfolding and ever-active dialogue among key stakeholders who are invested in defining terminology, collecting data, and determining how that data gets used. As a result, standardization is often organic, incremental and dynamic in nature.

Organic. All data standards initially begin as a discussion and debate over concepts important to a set of stakeholders invested in the use of the data standard. While there are numerous standards bodies and methodologies established to create a data standard, all valid data standards start with the stakeholders, and the stakeholders start with consensus on concepts.

What is an electrical outlet, a website or a person? Each of these initiated as concepts that the field had to reach consensus on before standards associated with them came into being. Standards efforts seek to fully articulate concepts in a tangible and concrete way. For example, once the appropriate stakeholders agree on the concept of a "person," the standards bodies then continue to work with invested stakeholders to define all the underlying concepts and attributes that make up a person (a person has a first name, a gender, a birthday, etc.). *This organic concept-to-standard path initiated by the stakeholders in the field applies directly to the current state of innovative school designs.* Key concepts and definitions in school design, such as competency-based education, blended learning, and personalized learning, are in ongoing, organic development through research and practice in education.

Incremental. In some instances, developing a robust data standard related to a concept occurs relatively easily. In others, full data standards around a given concept (or set of related concepts) may take several years. Along the way, priority is given to the more agreed-upon components where definitions have reached more common understanding and less dialogue and debate is required. Ultimately, standardization of a concept is not all-or-nothing. It is incremental and defines only those concepts where agreement can be reached, and only when it is reached. *Concepts in innovative school design may not yet be in a place to be standardized entirely, but the field appears ready for incremental steps in that direction.*

As interest and investment in school innovation have picked up over the last two decades, stakeholders have made efforts to coalesce around key concepts related to school design. The tagging system used to structure Canopy data has built upon previous categorization and tagging efforts, with the intention of moving the conversation forward and building greater consensus around these concepts. While there remains disagreement and ambiguity around some of the tags (for example, exactly what different stakeholders mean by "learner agency"), others have greater common understanding (such as "blended learning," which has a relatively well accepted definition[4]). Notional agreement at the conceptual level is the primary indicator for a concept being ready to enter the data standards development process.

Dynamic. Standards are not static. The objective of a data standard is to establish a concept as trusted, reliable and known, but standards do shift. For example, education data standards bodies are now taking another look at the elements "gender" or "sex". Whereas data standards for this idea have historically been dichotomous (male/female), the definitions and cultural shifts related to this element are changing and, as a result, so are the data standards. While every effort is made to be definitive, data standards are dynamic and can change as greater clarity or evolution of thought occurs over time. This flexibility in standardization should provide some level of comfort to stakeholders on the cutting edge of innovation in schools. **The emergent nature of innovative school design can coexist with efforts to develop data standards because as greater definition, clarity and understanding emerge, the standards are able to adapt**.

---

[4] http://blendedlearning.org

IV. THE ROLE OF STANDARDS BODIES

A standards body is an organization that supports and manages the development and use of a standard. The standards body is responsible for determining scenarios for use of the standard, or "use cases," such as when organizations supporting schools need to maintain and share data on the designs schools are implementing. Standards bodies define the use cases that require standardization, work with stakeholders to define the standard, and then make the standard accessible to others. Technically, anyone can develop a "standard." However, wide adoption and use is what is so powerful about standards. The more organizations use the standard, the greater the breadth of data can be shared and integrated. For this reason, we recommend working with existing standards bodies to maximize the impact and reach of the standard.

Within the education data ecosystem, four major standards bodies exist[5]. Each of these has a unique sector of education they seek to standardize, with occasional overlaps. When considering standardization of school innovation data, a landscape analysis of existing data standards efforts is important so that stakeholders can understand how standards bodies interact, and make informed choices about which standards body (or bodies) to engage as efforts to standardize move forward.

The four standards bodies explored in this report (see Appendix A) include Access4Learning (A4L), Common Education Data Standards (CEDS), Ed-Fi Alliance (Ed-Fi) and IMS Global (IMS). Each of these bodies works with stakeholders to define the use cases that require standardization, develop the standard and then make the standard accessible, either publicly or to a defined set of stakeholders.

As standards bodies have continued to mature, the need for greater collaboration and coordination has increased. At times, lack of clarity and an increasingly overlapping scope has caused confusion and occasional tension in the space, and has occasionally been referenced as the "standards wars". Over time, however, the standards bodies have worked to provide clarity to both the field, in terms of their use case and collaboration, and in their development processes. As an example, the CEDS and Ed-Fi initiatives have developed formal documentation and communication regarding the interplay of their data standards[6] and have taken tangible steps to reduce confusion through jointly developed projects[7]. In a similar step, A4L has also established a policy linking its data standard efforts directly to CEDS[8] and IMS has included CEDS data standards in its CASE standard and previously worked with CEDS for Open Badges and the Assessment Interoperability Framework. While there remains opportunity for greater collaboration and further clarity within the full scope of standards work, steps like these are starting to establish unified alignment at least at the data standard level. Based on this

---

[5] With regard to data, model and transport standards, four major standards bodies exist. For other standards that might be used by the field, see the Project Unicorn's Standards Glossary V1 https://www.projectunicorn.org/standards-glossary

[6] https://techdocs.ed-fi.org/display/ETKB/CEDS+and+Ed-Fi+Collaboration+Guidelines

[7] https://www.ed-fi.org/blog/2018/10/generate-ed-fi-generate-plugin-key-turnkey-federal-reporting/

[8] https://cdn.ymaws.com/www.a4l.org/resource/collection/354F9ABA-E440-409C-8DEA-4979A73839D9/Specification%20DM%20Development%20Processes%20-%20NA%20Ap.pdf

collaboration, we recommend starting data standard conversations with CEDS, as the other standards bodies look to CEDS when they develop out their data standard.

V.   ANALYSIS: Presence of School Design Elements in Existing Data Standards

Many organizations supporting school innovation are collecting and managing data on school design. The Canopy project represents, to our knowledge, one of the fullest efforts to represent data on elements of school design across many domains of innovation using a "tagging system." To begin to gauge how innovative school design elements fit into the landscape of existing data standards, AEM conducted an analysis of the extent to which Canopy tags matched existing standardized data elements. We reviewed the education data standards available through CEDS, Ed-Fi, A4L, and IMS Global to determine where terms from the tagging system appeared and if prevailing definitions already existed. The analysis revealed that 24 of the 88 tags (27%) developed for the Canopy have some level of commonality with existing data standards. Some of the Canopy tags that have some kind of presence in existing data standards include: *blended learning*, *students progress at own pace*, *access to information in more than one format*, *performance based assessment*, *competency framework*, and *credit for learning outside the classroom*. Complete information about their alignment can be found in Appendix B.

Although these concepts appear in the data standards, their application may differ from the intent of the Canopy tag. Sometimes there is a very close match between the Canopy tag's intended meaning and the existing data standard, such as in the case of *blended learning*. Blended learning is found in CEDS as a characteristic of a "course". In the Canopy process, nominators used the *blended learning* tag to indicate a school-wide strategy. Nevertheless, the intent of both the Canopy tag and the CEDS data element is to describe a learning modality characterized by integrated online and face-to-face learning experiences. Conceivably, CEDS data on blended learning courses in a school could be aggregated to demonstrate what percentage of the school's courses are blended, and furthermore what threshold of blended courses is required for the whole school's model to be considered blended learning. However, the converse, disaggregating data built from the Canopy tag, is not possible in this scenario because indicating that a school is employing blended learning as an instructional strategy school-wide would not integrate into a database with information structured at the course level. The lack of consistency across these scenarios underscores the need for standardizing data to ensure that comparable data is collected and can be integrated across multiple sources.

In most other cases, the match between the Canopy tag and the existing data standard is more loosely associated, as it is with *mental health services*. This Canopy tag is described as follows: "The school offers (or partners to offer) comprehensive counseling and mental health services for students." However, the related CEDS element, Student Support Service Type, collects information on whether an individual student receives mental health services, not on whether the school offers it. Existing data using the CEDS standard would not indicate whether the school offers (or partners to offer) mental health services, only that the student receives them. This existing data could not be aggregated for the purposes of identifying part of the school's model. Likewise, organizations building and collecting school innovation data could not use this existing CEDS element to manage and store data on the school's approach to mental health services.

The relatively small overlap between initial Canopy tags and existing data standards validates that stakeholders have not yet formalized this content area and, therefore, are not consistently collecting data on it. This analysis shows that for funders, school intermediaries, and research organizations to make use of data standards for school innovation in the field, existing data standards would need to be extended to incorporate data elements representing a range of innovative school designs.

VI.   HOW TO: Moving Towards Standardization

So far, we have made the case for why standardization is critical to solving the problem of fragmented school innovation data. We have also determined that many, if not most, elements of innovative school design that are common in today's school innovation lexicon do not exist in data standards today. The next step is to work towards standardization of new elements. Understanding when and how to standardize is critical to ensuring optimal success.

When to standardize

The answer is simple: now! As soon as people recognize the need to define or codify a concept, it is time to begin the process of standardization. There exists some agreement that the wide variety of innovative learning models and school designs need to be further defined and standardized. Organizations are currently building and collecting data about school innovation in siloes. But there is a need for these organizations to share what they are learning to advance research about how innovative school design is evolving. In fact, in many cases standardization work has already started: organic conversations and agreement are already occurring for some concepts.

Of course, beginning data standards work today doesn't mean that every concept will (or should) be integrated into data standards on the same timeline. The sections below offer insight to help stakeholders understand what information will need to be standardized, how different concepts might proceed towards standardization depending on their level of definition today, and how standards bodies can be involved.

Initial considerations in data standards development

Data standards are optimal when they provide clear descriptors for how data are defined, structured and related. Considerations should be given to existing and future uses of the data to ensure the standard is created in a manner that supports broad stakeholder use.

   Data element types. Defining a data element means reaching consensus on the terminology and definition of that element, but also on how it is collected and stored. For example, is it enough to know a school uses project-based learning (yes/no), or does the information need to be more detailed by determining what percentage of classrooms in the school use project-based learning, or understanding details about how project-based learning is implemented, such as whether it was used in conjunction with other strategies? Answering

these questions helps to determine the right element "path." Some examples of different element paths are:

- *Classic* - These elements represent the majority of elements in a data standard. They may be character strings, alphanumeric, numeric, etc., but are not an indicator, type or status element as defined below. Examples: Student Name, Course Identifier, or Course Title.
- *Indicator* – These are elements that answer the question, "are you or aren't you?" and generally involve a yes/no set of content. Example: Charter School Indicator – This element answers the question, "Are you a charter school?"
- *Type* – These are elements that are more nuanced than a simple yes/no by reflecting a range of options. Example: Student Support Services Type – Options for this element may include the range of support services a school offers such as physical therapy, braille service, case management services, or audiological services.
- *Status* – These are elements that indicate placement along a continuum. Example: National School Lunch Program Status – Options for this element may include non-participation in the program; participation without provision; or participation under Provision 1, 2 or 3.

Data model / relationships. Consideration must also be given to the level at which an element needs to be collected. Sometimes, elements collected at the base unit, such as student or course, can be aggregated to gauge what is happening at a school level. For example, as discussed above, the Blended Learning data element in CEDS can currently be collected at the course level using existing data standards. Then, to determine if a school is using blended learning as a school-wide strategy, saturation levels can be applied.

Sometimes, however, the school level needs to be the base unit. Again, referring to the Canopy tags discussed earlier, *mental health services* as defined in the tagging system would need to be collected at the school level. In this scenario, the data being determined is whether a school offers mental health services to families and students. Tracking that a student received a mental health service does not adequately answer whether the school offers services. While some could infer that if a student is receiving a service then the school offers it, this is not a guarantee. Similarly, if no students are indicated as receiving services, we cannot determine from that data whether the school does not offer services, or simply that no students are taking advantage of what is offered.

In some cases, Canopy tags being applied at the school level may not be appropriate for incorporation into data standards at that level. For example, *multi-age classrooms* clearly refers to the classroom or course level, and would likely need to be defined as such in data standards, so that having multiple age groups in a single course is a characteristic of the course. This information could then be aggregated to determine the extent to which multi-age groupings are a characteristic of the school's overall model.

Concept evolution. As discussed earlier, concepts organically evolve, and standardization is an iterative process that can take this evolution into account. Nevertheless, the concepts that are standardized should be well-defined and commonly understood enough to have some degree of staying power.

How to work with standards bodies

Often as a new innovative approach or design is emerging, early innovators, advocates and researchers get together to debate and define terminology. Although this phase may feel messy and nascent, it is the appropriate time for advocates and innovators to connect with one of the standards bodies described above. Standards bodies typically have regular "development cycles" during which they conduct formal or informal landscape analyses to determine what areas are of interest to their stakeholders. Standards bodies then work with stakeholders to define the use cases, develop the data standard and incorporate it in their next release, based on the development cycle. Standards bodies do not, however, have to be the convener or defining authority when it comes to data standards for new concepts. They define the governance structure for how new concepts integrate into the data standards and how they fit into the data model, but they look to subject matter experts in the relevant field to define the concept. While most standards bodies do convene stakeholders for the purposes of data standard development, other entities or organizations can also function in this role. Engaging with a standards body to provide proposed concepts and/or use cases is the most direct way to ensure emerging concepts from the field are established and propagated.

Once the need for standardizing a concept has been demonstrated, key stakeholders (funders, researchers) need to determine the extent to which they want to be active participants in driving towards standardization—and what role they want to play in relation to standards bodies. There are generally three approaches to working towards standardization. While these are not formalized pathways, we describe them in order to help school innovation stakeholders better understand the levels of engagement they might opt for when working towards standardization.

- **DIY.** This pathway would mean developing a set of original "data standards" for use only within a predefined group of school innovation stakeholders. With this option, there would not be a larger effort to establish a common language used by all, but rather one used for a specific purpose (such as for combining a limited set of school innovation datasets to create an aggregated dataset). School innovation stakeholders would decide amongst themselves whether any concepts are at a point at which "tags" and other data elements could be standardized. Standardization would mean a definition exists for the tag, and those using the data would understand the nomenclature being used, which is essentially the aim of the current Canopy tagging system. While a "do it yourself" (DIY) approach to data standards can appear attractive to stakeholders initially, the extensibility and long-term effectiveness are significantly less. A DIY approach could risk perpetuating an echo chamber effect in school innovation if the data standard is not promoted for broad use. In addition, a DIY approach that is later brought to a standards body might require significant deconstruction or change, resulting in a higher barrier of entry to adapt to existing data standards. In turn this would negatively impact stakeholders who bought in early, since they would be required to modify their efforts to align to required changes in the data standard or risk being out-of-sync with the community.

- o **Benefits for stakeholders:** Ability to fully control the development of the standard. Having full control over a standard, with a hand-picked group of stakeholders, means that the data dictionary and data model can be closely tailored to a specific set of use cases. Decision-making may involve fewer parties.
- o **Challenges for stakeholders:** Limits the extent to which the field recognizes the established nomenclature and definition, resulting in standardization for a limited set of stakeholders. Lack of standardization across the field results in difficulty packaging and transporting data for integration. This makes building on the research and experience of others difficult and problematic. Sustainability is difficult and can be cost-prohibitive. If a large portion of the stakeholder population is not using the data standard it quickly becomes moot, and pushing the field for sustainability can be cost-prohibitive.

From a long-term perspective and with the benefit of having seen other groups attempt DIY data standards, we strongly recommend engaging with standards bodies instead of making your own data standards.

- **Contribute.** This pathway involves more passive engagement with standards bodies, including a "hand-off" from stakeholders to standards bodies during the process. In this case, after stakeholders determine certain concepts in school design are beginning to coalesce around common terms and definitions, they pass all of the vetted information off to one or more standards bodies to incorporate wholesale into their existing standards. At that time, the standards bodies will follow their development models to define the data elements related to the concepts. Regardless of where a standards body is in its current development cycle, stakeholders can propose new use cases to explore at any time. The use case will then be added to the standards body's docket for consideration when a new development cycle begins. Once the new concepts are integrated into data standards, standards bodies will push all stakeholders to use the data standards. This means the breadth and type of stakeholders who will adopt the data standard is broader than with a "DIY" approach, for example enabling schools and districts to adopt elements within their data systems.

  - o **Benefits for stakeholders:** lower upfront coordination costs; stakeholders have the opportunity to remain involved to the extent they are comfortable; the resulting data standard will be accepted by a broader set of stakeholders compared to a DIY approach.
  - o **Challenges for stakeholders:** Inefficient in the handoff from stakeholders to standards bodies because it usually involves some "undoing" or reverse engineering to fit into the existing data standards; timeline determined by the standards bodies' priorities, bandwidth, and funding; no guarantee new elements will be incorporated.

- **Partner.** This pathway involves a greater degree of active collaboration between school innovation stakeholders and standards bodies. With this option, stakeholders should proactively bring at least one standards body into the conversation early. The standards body, funders and researchers involved in school innovation will all bring appropriate stakeholders to the table. The review against existing data standards and use cases will

occur early, allowing standardization to be informed by prior efforts and more readily fit within existing models. Similar to the "Contribute" path above, new concepts in school innovation would be incorporated into existing data standards, increasing the breadth of adoption among stakeholders compared to a "DIY" approach.

- o **Benefits for stakeholders:** Active hand in building and defining what becomes standard; potentially faster and more efficient pathway (in that it avoids the "undoing" inherent in the Contribute approach)
- o **Challenges for stakeholders:** Higher level of effort and investment than the Contribute approach, level of effort more in line with DIY approach; higher level of responsibility for funder and/or grantee to drive the conversation effectively

Starting points for standardization

We have already argued that the time to begin standardizing school innovation data is now. However, the time needed to develop a data standard varies from several months to a year or more. Developing a data standard from the beginning, especially with no existing field-established definitions, takes longer than incorporating definitions from existing data standards. Specific concepts may start this process from different places, largely having to do with how much definitional work and notional agreement is already in place. There are three starting points for data standardization.

Starting Point 1: The need for a definition exists, but definitional work has not yet happened. In this starting point, the concept is recognized, even if it's not well defined. This means it's being practiced in the field, and likely documented. If people are collecting data about it, that data is being codified in inconsistent ways. More definitional work is needed before the concept is ready to become standardized. Standards bodies prefer to be brought into the conversation at this point as a bystander, not to drive the conversation. Having the standards body involved at this point ensures that (1) the standardized definition does not already exist elsewhere; and (2) when the concept is ready to be integrated into the standard, the standards body will be prepared to naturally fit it in, rather than retrofitting or needing to deconstruct what has already been established in order to fit it in. Once a standardized concept and definition have been reached, standards bodies will disseminate them to the field, including the other standards bodies.

> SCHOOL INNOVATION EXAMPLE:
>
> *People are interested in, and investing in, concepts like learner agency, equity, and design at the margins, but common understanding and consistent codification do not yet exist.*

Starting point 2: Definitional work has already happened, but the concept does not yet exist in data standards. In this starting point, working definitions for the concept already exist. At least one definition has been documented, and has followed some standardization process among a group of stakeholders, but not necessarily with the involvement of a standards body, so the concept might be considered only partially standardized. The next step is to involve a standards body who will use this as a starting point, bring other stakeholders to the table, and make sure there is full buy-in. Once the concept and definition are brought into a standards body, it follows the governance process of the standards body. The standards body will then disseminate the standardized concept and definition to the field, including the other standards bodies.

> SCHOOL INNOVATION EXAMPLE:
>
> *Definitional work has already happened for concepts like competency-based education, universal design for learning, social and emotional learning, and project-based learning. People are actively building and managing data about these concepts, but not necessarily in common ways.*

Starting point 3: The concept already exists in data standards. In this starting point, some version of the concept has already been standardized for other purposes. At this point, a review needs to be conducted to determine if the purpose of the existing data standard aligns with any new use cases. The standards body will provide guidance on the existing use cases and convene appropriate stakeholders to review the new use cases. If the new use cases are not aligned to the existing data standard, the standards body and stakeholders will determine if the existing data standard needs to be modified or a new element created. Other standards bodies will be informed of the work to determine integration across all standards.

> SCHOOL INNOVATION EXAMPLE:
>
> *The tags found in Appendix B, such as blended learning, currently exist in data standards in some form. Review of the data standards would determine if the existing data standard is meeting the use case of school innovation.*

VII.   CONCLUSION: Recommendations for Action

The school innovation field is primed for starting down the standardization path. The very existence of the Canopy project is evidence that school innovation stakeholders have a need for broader, more consistent data on innovative school design, which in many cases will only become possible with the interoperability that data standards afford. As for the data standards themselves, many of the concepts within school design are already understood among stakeholders. While these concepts, such as those indicated by Canopy tags, are at various starting points in the path towards standardization, there is great potential for further definitional work on the concepts, and extension of existing data standards to reflect school design.

Below is a set of recommendations that sum up many of the points made in this report in actionable next steps.

ACTION 1: Make the case for data standards and build momentum towards the development of data standards. This report serves as a good starting point for elevating the case for standardization of innovative school design concepts. By sharing this information on the importance and process of standardization with relevant stakeholders, stakeholders can create greater awareness and willingness to move towards standardization. Funders of school innovation research are a significant stakeholder in this space. Engaging with funders to increase awareness and gauge interest in supporting ongoing efforts for standardization of innovative school design concepts is critical.

ACTION 2: Sort common and emerging terms describing school design into "starting points" above and proceed towards standardization. Determining where concepts in innovative school design are relative to the three defined starting points is an important step towards standardization. Regardless of the starting points, we recommend connecting with standards bodies to allow them to share more about their efforts, processes, and means of

ACTION 1: MAKE THE CASE AND
         BUILD MOMENTUM
ACTION 2: SORT TAGS INTO
         'STARTING POINTS'
ACTION 3: ENGAGE IN STANDARDS
         AROUND TRANSPORT
ACTION 4: USE STANDARDS!

engagement and to ensure innovative school design concepts are on their radar will foster a fertile environment for future engagement. See Appendix A for contact information to engage standards bodies.

Starting Point 1: Identify high-priority emerging concepts and fund research to define and codify them. Some of these emerging concepts may be identified in the Canopy tagging system. Where appropriate, conduct further research and development, landscape scans of frameworks, and convene stakeholders to begin to push towards consensus. As this work grows, involve or update standards bodies on the definitional work underway.

Starting Point 2: Engage with standards bodies if definitions already exist but concepts are not yet integrated in data standards. Determine whether to take a "contribute" or "partner" approach to standards bodies. As CEDS is the source utilized by other standards bodies for the data standard, reach out to CEDS to understand the development cycle, method of engagement, and process for incorporation into other standards.

Starting Point 3: Build from the analysis in this report (see Appendix B) to determine whether concepts already present in data standards are meeting the need in the field. In cases where data standards already exist, stakeholders should conduct a careful review of the usability, comparability and alignment of these data standards with the use cases and needs of this specific stakeholder group. Where there is disagreement, confusion or conflicting concepts or definitions, reach out to the appropriate standards body to open communication. Define specific use cases being considered and document against existing data standards to determine if any modifications or additions to the data standard are necessary. A "contribute" or "partner" approach can be selected when working to resolve disconnects with existing data standards.

ACTION 3: As the data standards process is underway, engage with standards bodies to develop transport standards. In order to fully harness the power of standardization, it is important to define transport standards, the process whereby one system shares data electronically with another. As concepts in school design are in the process of being standardized both in terms of a data standard and a data model, working with standards bodies (A4L, Ed-Fi, IMS) who develop interoperability standards (transport) is the next step.

ACTION 4: Use standards! The power of standardization is realized in use by the community at large. For existing datasets and databases, there is no immediate need to make physical changes to data. Instead, conduct mapping exercises between the data and existing data standards to ensure the meaning of the data can be expressed through the data standard with the help of a translation guide that shows which data standards map onto which data fields. For any new data collections or database development, build according to the data standard itself by using the standardized definition and code set, if one has been defined, for the element. Write expectations for use of existing data standards into grant agreements where new data collections or database development might occur. Pursue conversations with state education innovation agencies, as state use of data standards has a downstream effect on district adoption.

Working concertedly towards standardization, in cooperation with standards bodies, is an important lever for better collective knowledge and increased impact among school innovation stakeholders. Data standards provide a structure for collaboration across data management efforts that are currently woefully fragmented. By standardizing concepts in innovative school design and promoting widespread adoption of standards, funders, intermediaries and research organizations will be able to more easily transition from the siloed collections of information on innovative schools to a robust system of shared data across projects. Formation and adoption of data standards also opens up new opportunities for both where to source data at greater scale, as well as where data might be brought in to enrich research and publicly accessible databases. As a result, shared knowledge reflecting a more complete picture of school innovation across the country will be broadly accessible.

Appendix A: Education Data Standards Bodies

This appendix provides additional information about the four major education standards bodies with regard to data, model, and transport standards. However, other standards bodies exist in the education space. For more information about these standards bodies, refer to the Project Unicorn Standards Glossary at https://docs.wixstatic.com/ugd/f384a6_ebf7cfe898d34240949841affee1cbaa.pdf.

Access4Learning Community

Description	Supports the development of the SIF standards. "The Access 4 Learning (A4L) Community, previously the SIF Association, is a unique, non-profit collaboration composed of schools, districts, local authorities, states, US and International Ministries of Education, software vendors and consultants who collectively address all aspects of learning information management and access to support learning. The A4L Community is "Powered by SIF" Specifications as its major technical tool to allow for this management and access simply, securely and in a scalable, standard way regardless of the platform hosting those applications." (Source: A4L press release)
Use Case	P20W
Standard(s)	• Data Standard (Aligned with CEDS) • Data Model • Data Transport (Serialization & API)
Established	1999
Engaging the standards body	All Use Cases which highlight the use of open standards (including, but not limited to the use of the SIF standard) and can demonstrate a benefit (administrational, financial etc.) to the education sector are encouraged via the Online Submission page. The By-Laws which govern the A4L Community, allows for 'invited' interested parties to participate in the standards development. 'Invited' parties do not have to be members of the A4L Community.
Reference	https://www.a4l.org

Common Education Data Standards (CEDS)

Description	Supports the Common Education Data Standard and its tool suite. "CEDS is an education data management initiative whose purpose is to streamline the understanding of data within and across P-20W institutions and sectors." (Source: CEDS)
Use Case	P20W
Standard(s)	• Data Standard • Data Model
Established	2009
Engaging the standards body	All use cases relevant to P20W education are encouraged. Stakeholders can submit issues via the CEDS Open Source Community on GitHub or the CEDS Community of Practice.
Reference	https://ceds.ed.gov
Note	AEM has worked alongside the US Department of Education with the management and development of CEDS for the past ten years.

Ed-Fi Alliance

Description	Supports the Ed-Fi data standard and technology suite for K12. "The Ed-Fi Data Standard is a set of rules that allow (previously disconnected) educational data systems to connect. Any educational technology that's powered by Ed-Fi—whether a student information system, a rostering tool, assessment software, etc.—can connect with any other." (Source: Ed-Fi)
Use Case	K12
Standard(s)	• Data Standard (Aligned with CEDS) • Data Model • Data Transport (Serialization & API)
Engaging the standards body	The Ed-Fi Governance Advisory Team "serves as the formal liaison between the Ed-Fi Community and our internal team, coordinating the collection and review of educator, IT, and business perspectives." A list of Ed-Fi Governance Advisory Team members and their contact information can be found at https://www.ed-fi.org/blog/2018/11/ed-fis-new-internal-governance-structure/.
Established	2011
Reference	https://www.ed-fi.org/

IMS Global

Description	Supports the adoption and impact of innovative learning technology. "IMS Global is a non-profit organization that advances technology to scale and improve educational participation and attainment affordably. IMS Global members are leading suppliers, institutions, and government organizations that are enabling the future of education by collaborating on interoperability and adoption initiatives." (Source: IMS)
Use Case	K-20
Standard(s)	• Data Dictionary • Data Transport (Serialization & API)
Engaging the standards body	More than 75 School Districts and State Education Agencies engage in IMS Global as Affiliate and Contributing Members, providing guidance and leadership on the organization's direction and standards development. This is accomplished through the K-12 Leadership Board, K-12 and SEA Steering Committees, and Innovation Leadership Networks (ILN) focused on making learning tools interoperable across the digital learning ecosystem. Information on IMS Global membership can be found at https://www.imsglobal.org/imsmembership.html.
Established	1997
Reference	https://www.imsglobal.org

Appendix B: Analysis of Canopy Tags' Alignment to Existing Standards

All Canopy tags (both "general approaches" and "specific practices") were analyzed against the four major education data standards (CEDS, Ed-Fi, SIF, and IMS Global) to determine to what extent data standards already exist. Of the 88 tags analyzed, 24 tags (27%) have commonality with CEDS, Ed-Fi or SIF. One-to-one element commonalities were not found with IMS Global, however concepts are similar between Canopy tags and a variety of IMS Global interoperability standards.

This analysis was conducted in December 2018. Every effort was made to provide accurate representations of the elements in these standards that align to the Canopy tags. However, it is possible that there are elements that may have been missed, or alignments that may exist within all four of the standards that were not captured herein, or that new elements have emerged since the date of review due to the dynamic nature of standards. Future engagement with the standards bodies will highlight these if they exist. The analysis was conducted by searching each of the standards using the following criteria:

- Search for identical terminology to the Canopy tag (e.g., search for 'blended learning')

- Search for terminology similar to the Canopy tag (e.g., search for 'learning resource' for the Canopy tag that includes the words 'instructional materials')

- Search for entities in the standard that relate to the Canopy tag (e.g., search the course entity when looking for a match for 'students progress at own pace')

- Perform cross-comparison with the other standards after finding an element in one standard (e.g., searched SIF for the words "learning standard" after finding the learning standard entity in Ed-Fi)

- Conduct review of analysis by staff familiar with the various standards

The results of the analysis shown below are for the 24 tags that were found to have a match. The Canopy tag is listed as the header followed by a table showing the results from CEDS v7.1, Ed-Fi v3.0 SIF v2.7, and IMS Interoperability Standards.

Canopy tag: "Blended Learning" and associated model tags (7)

CEDS	Ed-Fi	SIF	IMS Global
Blended Learning Model Type	*Section | Section Characteristic | CodeValue*	*SectionInfo / MediumOfInstruction*	
Similar definition. Same intent.	Collects if a course is blended learning.	Similar definition. No code set is available for this element. Any code set can be used here.	Could not locate within IMS

Tags	*CEDS options within Blended Learning Model Type*
Station rotation	Rotation
Lab rotation	
Individual rotation	
Flipped classroom	*No matching option*
Flex model	Flex model
A la carte model	A la carte model
Enriched virtual model	Enriched virtual model

Canopy tag: "Students Progress At Own Pace"

CEDS	Ed-Fi	SIF	IMS Global
Course Interaction Mode			*Learning Design*
Similar intent. Differing definitions.	Could not locate within Ed-Fi	Could not locate within SIF	Learning Design is a standard that supports multiple pedagogies in online learning, including students progressing at their own pace.

Canopy tag: "Access to Information in More Than One Format"

CEDS	Ed-Fi	SIF	IMS Global
Learning Resource Physical Media Type			*Common Cartridge*
Collects the format type. Information can be derived.	Could not locate within Ed-Fi	Could not locate within SIF	Common Cartridge is a standard regarding digital course materials. If the format for information is digital, this information could be derived.

Canopy tag: "Performance Based Assessment"

CEDS	Ed-Fi	SIF	IMS Global
Assessment Type	*AssessmentCategoryDescriptor*	*StudentScoreSet / ScoreMetric*	*Question and Test Interoperability Assessment Test, Section and Item Information Model*
Information can be derived.	Describes if performance based.	Information can be derived.	See Section 4, Items, which provides elements related to item type. Performance-based assessments generally contain open-ended questions which would be supported in Section 4.

Canopy tag: "Competency Framework"

CEDS	Ed-Fi	SIF	IMS Global
Competency Framework	*LearningStandard/ ContentStandard*	*/learningStandardDocuments/ learningStandardDocument*	*Competencies and Academic Standards Exchange (CASE)*
Entire category of elements within the Assessment domain with elements such as ID, description, dates, subject, and title.	Competencies are found with the learning standard for an artifact.	This contains many elements related to competency framework.	See Section 2, Use Cases, for information on how the CASE can be used regarding competency framework.

Canopy tag: "Credit for Learning Outside the Classroom"

CEDS	Ed-Fi	SIF	IMS Global
Work-based Learning Opportunity Type			
Information can be derived.	Could not locate within Ed-Fi	Could not locate within SIF	Could not locate within IMS

Canopy tag: "Measures for College Readiness"

CEDS	Ed-Fi	SIF	IMS Global
High School Diploma Type	*StudentAcademicRecord | Diploma | DiplomaType*	*StudentAcademicRecord | K12StudentAcademicRecord | GraduationDiplomaType*	*Question and Test Interoperability Assessment Test, Section and Item Information Model*
Just one example of an aligned element. CEDS has several elements that would meet this criteria depending on how a school defines college readiness.	Just one example of an aligned element. Ed-FI has several elements that would meet this criteria depending on how a school defines college readiness.	Just one example of an aligned element. SIF has several elements that would meet this criteria depending on how a school defines college readiness.	See Section 5, Outcome Variables, which provides elements related to Assessment Scores, which can be used to assess college readiness.

Canopy tag: "Measures for Career Readiness"

CEDS	Ed-Fi	SIF	IMS Global
Career and Technical Education Completer *Professional or Technical Credential Conferred*	*StudentAcademicRecord | Diploma*	*/students/student/ vocationalConcentrator*	*Question and Test Interoperability Assessment Test, Section and Item Information Model*
Just two examples of an aligned element. CEDS has several elements that would meet these criteria depending on how a school defines career readiness.	Just one example of an aligned element. Ed-FI has several elements that would meet these criteria depending on how a school defines career readiness.	Just one example of an aligned element. SIF has several elements that would meet these criteria depending on how a school defines career readiness.	See Section 5, Outcome Variables, which provides elements related to Assessment Scores, which can be used to assess college readiness.

Canopy tag: "High Quality Instructional Materials"

CEDS	Ed-Fi	SIF	IMS Global
Learning Resource Peer Rating Value		*LearningResource / Evaluations / LearningResourceEvaluationType / (Description/Date/Name)*	
This is the peer rating value for learning resources. Can derive 'high quality' based on ratings.	Could not locate within Ed-Fi	Information can be derived based on the evaluation of the learning resource.	Could not locate within IMS

Canopy tag: "Disaggregated Data"

CEDS	Ed-Fi	SIF	IMS Global
CEDS contains demographics as well as typical subpopulations	Ed-Fi contains demographics as well as typical subpopulations	SIF contains demographics as well as typical subpopulations	Could not locate within IMS

Canopy tags (3): "Supports for high poverty and homeless students, immigrants and refugees, English Language Learners"

CEDS	Ed-Fi	SIF	IMS Global
Elements exist within the standard to identify these subpopulations as well as historically well-defined programs. We believe, however, there are likely gaps in the standards for the types of supports that might be articulated in innovative school design.	Elements exist within the standard to identify these subpopulations as well as historically well-defined programs. We believe, however, there are likely gaps in the standards for the types of supports that might be articulated in innovative school design.	Elements exist within the standard to identify these subpopulations as well as historically well-defined programs. We believe, however, there are likely gaps in the standards for the types of supports that might be articulated in innovative school design.	Could not locate within IMS

Canopy tag: "Mental Health Services"

CEDS	Ed-Fi	SIF	IMS Global
Student Support Service Type	*Program Characteristic Descriptor*	*/sres/sre/specialEducation/ serviceList/service/serviceCode/ code*	
Falls under Individualized Program which is available school wide.	If provided as part of a special education program, can be determined. Does not exist for school wide.	Found in special education. Does not exist for school wide.	Could not locate within IMS

Canopy tag: "Physical Health Services"

CEDS	Ed-Fi	SIF	IMS Global
Student Support Service Type	*Program Characteristic Descriptor*	*/sres/sre/specialEducation/ serviceList/service/serviceCode/ code*	
Falls under Individualized Program which is presumably a special education program. Does not exist for school wide.	If provided as part of a special education program, can be determined. Does not exist for school wide.	Found in special education. Does not exist for school wide.	Could not locate within IMS

Canopy tag: "Family & Community Supports"

CEDS	Ed-Fi	SIF	IMS Global
Student Support Service Type	*Program Characteristic Descriptor*	*/sres/sre/specialEducation/ serviceList/service/serviceCode/ code*	
Falls under Individualized Program which is presumably a special education program. Does not exist for school wide.	If provided as part of a special education program, can be determined. Does not exist for school wide.	Found in special education. Does not exist for school wide.	Could not locate within IMS

Canopy tag: "Expanded Open Hours"

CEDS	Ed-Fi	SIF	IMS Global
Increased Learning Time Type			
Offering additional hours can be determined with this element	Could not locate within Ed-Fi	Could not locate within SIF	Could not locate within IMS