In the following report, Hanover Research reviews tools and best practices for process management and visualization in public school districts.
## TABLE OF CONTENTS

Executive Summary and Key Findings ................................................................. 3

**INTRODUCTION** ........................................................................................................ 3
**KEY FINDINGS** ........................................................................................................ 3

**Section I: Review of Process Management Tools** .............................................. 5

**CONCEPTUAL TOOLS: CHECKLISTS AND FLOWCHARTS** ................................. 5
  - Checklists .................................................................................................................. 5
  - Flowcharts ............................................................................................................... 10

**MANAGEMENT PROCESSES WITH VISUALIZATIONS** ....................................... 14
  - Annenberg Center for School reform Self-Study Process .................................. 14
  - Plan Do Study Act Cycle ....................................................................................... 16
  - Six Sigma ............................................................................................................. 18

**Section II: Profiles** ............................................................................................. 22

  - ADAMS 12 FIVE STAR SCHOOLS ................................................................. 22
  - MONTGOMERY COUNTY PUBLIC SCHOOLS ............................................... 23
  - IREDELL-STATESVILLE SCHOOLS ............................................................ 27
EXECUTIVE SUMMARY AND KEY FINDINGS

INTRODUCTION

In his 2012 TED talk, Atul Gawande, surgeon and professor at Harvard Medical School, describes how the simplicity of checklists belies their usefulness and impact on complex processes—not only for those low “on the totem pole” but for “the entire team.” \(^1\)

Making systems work, whether in health care, education, climate change, making a pathway out of poverty, is the great task of our generation as a whole. In every field, knowledge has exploded, but it has brought complexity, it has brought specialization. And we’ve come to a place where we have no choice but to recognize, as individualistic as we want to be, complexity requires group success. We all need to be pit crews now. \(^2\)

As the use of checklists is transferable across industry and essential to even the uppermost levels of specialization, checklists can be applied to K-12 settings to improve the precision or quality of work. Therefore, the current report explores the use of process checklists, visualization, and management. This report includes the following sections:

- **Section I** reviews tools that school districts can use to improve process management, ensure the consistent process implementation, and to identify inefficiencies or areas for improvement.
- **Section II** profiles three school districts that have been recognized for the quality of their process visualization or mapping. This section relies on publicly available district resources, including district websites and planning and evaluation documents.

KEY FINDINGS

- **Checklists help systematize the sequencing of complex processes and ensure consistent implementation of those processes and best practices.** In his book *The Checklist Manifesto*, Atul Gawande recommends that checklists include between five and nine “killer items” that are likely to be skipped but are crucial to the success of a process. However, the actual number of checklist items will vary and ultimately depends upon the context of the process.

- **There is not a “single best” management tool to encapsulate, analyze, and improve educational processes, so K-12 entities have adopted different education-specific tools or adapted ones from the business sector.** More specifically, the “Plan, Do, Study, Act (PDSA) Cycle” and Six Sigma were originally developed to improve business process quality but have been adapted to improve processes in schools and districts. The Adams 12 Five Star Schools (CO) and Montgomery County

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\(^1\) “Subtitles and Transcript – Atul Gawande – How do we heal medicine?” TED.
http://www.ted.com/talks/atul_gawande_how_do_we_heal_medicine/transcript?language=en

\(^2\) Quote taken verbatim from *Ibid.*
Public Schools (MD) both use Six Sigma to improve processes. The PDSA Cycle is used by Montgomery County Public Schools and Iredell-Statesville Schools (NC).

- **Flowcharts help develop an understanding of processes among relative actors, which then enables standardization and monitoring of those processes for improvement.** Flowcharts consist of a series of standardized shapes depicting sequences of actions and can be more effective in conceptualizing processes than using narrative descriptions alone. The conceptualization and insight generated by flowcharts can identify inefficiencies, enhancements, or facilitate continuous improvement.

- **Process visualizations encourage a continuous, cyclical approach to improvement rather.** For example, the Annenberg Center for School Reform’s self-study process uses a repeated cycle of questioning, data analysis, plan implementation, and evaluation to improve performance in focus areas related to student achievement. Likewise, the PDSA Cycle consists of four steps which are continuously repeated to drive process improvement.
SECTION I: REVIEW OF PROCESS MANAGEMENT TOOLS

In this section, Hanover Research reviews tools that school districts can use to improve process management, ensure the consistent process implementation, and to identify inefficiencies or areas for improvement. More specifically, Section I is divided into two main subsections - conceptual tools (checklists and flowcharts) and management processes with visualizations (the self-study process, the “Plan, Do, Study, Act (PDSA) Cycle”, and Six Sigma).

CONCEPTUAL TOOLS: CHECKLISTS AND FLOWCHARTS

Checklists

Checklists are useful for specifying precise sequences of activities for any complex process such as surgery, construction, or aviation. According to Atul Gawande, the surgeon who wrote *The Checklist Manifesto* based on his experiences using checklists to dramatically reduce infections in hospitals, checklists must be balanced with the autonomy of individuals and groups to adapt to changing circumstances and apply their own judgement within set procedures. Gawande recommends that checklists include between five and nine “killer items,” steps that are among the most dangerous to skip, but are likely to be skipped anyway. Items should be worded in a way that is easily understood by users, and checklists should be tested in real world applications and revised until they work consistently.3

However, in practice, checklists for school processes vary in length and can be much longer than Gawande’s recommendation of five to nine items. Ultimately, the number of items included in a checklist depends on the context in which the checklist is used.4 For example, checklists that assess long-term processes, such as school safety and school improvement, may include more items than checklists used to assess short-term processes, such as a daily lesson. However, long checklists can be shortened by consolidating discrete items into broader categories to provide comprehensive documentation that is still manageable.

The remainder of this subsection describes different purposes for applying checklists within a K-12 context – regulatory compliance, alignment to best practices, ensuring fidelity of implementation, or improving classroom management. These examples are not exhaustive of the ways checklists may be applied in an educational setting, but contextualize how checklists are broadly transferrable and relevant to K-12 settings.

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4 Ibid., p. 9.
**REGULATORY COMPLIANCE**

First, **checklists can be used to ensure compliance with required tasks**, particularly for school safety.\(^5\) Figure 1.1 shows a sample school safety checklist, the General Classroom Conditions Self-Inspection Checklist published by the Centers for Disease Control’s National Institute for Occupational Safety and Health (NIOSH). This checklist is more than twice the length of Gawande’s recommended checklist, but all 24 items are necessary for school safety inspections.

![Figure 1.1: General Classroom Conditions Self-Inspection Checklist](http://www.cdc.gov/niosh/docs/2004-101/chklists/r1n05g~1.htm)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QUESTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Are all changes in classroom use and alterations, repairs, construction, or installation of new equipment reviewed with the appropriate State and local agency that has jurisdiction over school modifications?</td>
</tr>
<tr>
<td>2</td>
<td>Is an electric solenoid key-operated gas shut-off switch installed on each gas supply line to your shop, lab or instructional area?</td>
</tr>
<tr>
<td>3</td>
<td>Are classrooms kept clean and free from debris to the greatest extent practical given the types of activities being performed?</td>
</tr>
<tr>
<td>4</td>
<td>Are waste materials that are prone to rotting placed in leakproof receptacles with tight fitting covers and removed daily for disposal?</td>
</tr>
<tr>
<td>5</td>
<td>Are classrooms maintained, as far as reasonably practicable, to prevent the entrance or harborage of rodents, insects, and other vermin?</td>
</tr>
<tr>
<td>6</td>
<td>Is water available that is suitable for drinking, personal hygiene, food preparation or cleaning?</td>
</tr>
<tr>
<td>7</td>
<td>Are all nondrinkable water outlets clearly marked as such?</td>
</tr>
<tr>
<td>8</td>
<td>Are lavatories equipped with hot and cold running water, hand soap, and towels or driers?</td>
</tr>
<tr>
<td>9</td>
<td>Where showers are required, are soap, hot and cold running water through a common discharge line, and individual towels provided?</td>
</tr>
<tr>
<td>10</td>
<td>Is the consumption of food and beverages prohibited in or near toilet rooms or areas containing toxic materials?</td>
</tr>
<tr>
<td>11</td>
<td>Is storage of food or beverages prohibited in toilet rooms or in an area exposed to a toxic material?</td>
</tr>
<tr>
<td>12</td>
<td>Where employees are required to wear protective clothing, are change rooms provided with storage facilities for street clothes and separate storage facilities for the protective clothing?</td>
</tr>
<tr>
<td>13</td>
<td>Is material stored so as not to create a hazard? Note: Bags, containers, bundles, etc., stored in tiers must be stacked, blocked, interlocked, and limited in height so that they are stable and secured against sliding and collapse.</td>
</tr>
<tr>
<td>14</td>
<td>Are storage areas kept free from hazards that may cause tripping, fire, explosion, or pest harborage?</td>
</tr>
<tr>
<td>15</td>
<td>Is sufficient safe clearance available through aisles, loading docks, turns, or doorways when mechanical handling equipment is used?</td>
</tr>
<tr>
<td>16</td>
<td>Are head clearance warning signs provided where needed?</td>
</tr>
<tr>
<td>17</td>
<td>Are all passageways, work areas, storerooms, and washing facilities kept orderly and sanitary? Note: Examples of violations include floor areas strewn with lumber, tires, books, and boxes.</td>
</tr>
<tr>
<td>18</td>
<td>Are all floors kept clean and as far as possible dry?</td>
</tr>
<tr>
<td>19</td>
<td>If floors are likely to get wet (such as in food preparation), are platforms, mats, or other dry standing places provided where practicable?</td>
</tr>
<tr>
<td>20</td>
<td>Are all floors kept free of protruding nails, splinters, holes, or loose boards?</td>
</tr>
<tr>
<td>21</td>
<td>Are aisles and passageways kept clear and in good repair, with no obstructions that could create a hazard?</td>
</tr>
<tr>
<td>22</td>
<td>Are covers and/or guardrails provided to protect people from falling into pits, tanks, vats, ditches, etc.?</td>
</tr>
<tr>
<td>23</td>
<td>Are areas used for storage of materials marked with conspicuous signs that indicate the load-bearing capacity of the floor?</td>
</tr>
<tr>
<td>24</td>
<td>Is the weight of stored materials assessed to ensure that it is below the load-bearing capacity of the floor?</td>
</tr>
</tbody>
</table>

Source: Centers for Disease Control\(^6\)

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**ENSURING BEST PRACTICES**

In addition to facilitating procedural compliance, **checklists can be used in efforts to ensure programmatic alignment to best practices.** For example, Figure 1.2 presents a checklist of essential elements for project-based learning (PBL) from the Buck Institute for Education, a leading organization in PBL. This checklist, which is used to evaluate individual classroom activities or longer-term class projects, contains a total of eight items.

**Figure 1.2: PBL Essential Elements Checklist**

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus on Significant Content</td>
<td>At its core, the project is focused on teaching students important knowledge and skills, derived from standards and key concepts at the heart of academic subjects.</td>
</tr>
<tr>
<td>Develop 21\textsuperscript{st} Century Competencies</td>
<td>Students build competencies valuable for today’s world, such as critical thinking/problem solving, collaboration, and communication, and creativity/innovation, which are taught and assessed.</td>
</tr>
<tr>
<td>Engage Students in In-Depth Inquiry</td>
<td>Students are engaged in a rigorous, extended process of asking questions, using resources, and developing answers.</td>
</tr>
<tr>
<td>Organize Tasks Around a Driving Question</td>
<td>Project work is focused by an open-ended question that students understand and find intriguing, which captures their task or frames their exploration.</td>
</tr>
<tr>
<td>Establish a Need to Know</td>
<td>Students see the need to gain knowledge, understand concepts, and apply skills in order to answer the Driving Question and create project products, beginning with an Entry Event that generates interest and curiosity.</td>
</tr>
<tr>
<td>Encourage Voice and Choice</td>
<td>Students are allowed to make some choices about the products to be created, how they work, and how they use their time, guided by the teacher and depending on age level and PBL experience.</td>
</tr>
<tr>
<td>Incorporate Critique and Revision</td>
<td>The project includes processes for students to give and receive feedback on the quality of their work, leading them to make revisions or conduct further inquiry.</td>
</tr>
<tr>
<td>Include a Public Audience</td>
<td>Students present their work to other people, beyond their classmates and teacher.</td>
</tr>
</tbody>
</table>

Source: Buck Institute for Education

**FIDELITY OF IMPLEMENTATION**

At a deeper level, **checklists can be used to ensure that school improvement strategies are implemented with fidelity.** A 2011 article in the journal *Phi Delta Kappan* recommends that district leaders develop checklists that specify each staff member’s responsibilities in implementing a school improvement strategy. Leaders should use regular structured collaboration to evaluate the implementation of checklist items and ensure their proper implementation. Figure 1.3, on the next page shows a checklist of Key Actions for school improvement, taken from the Maryland State Department of Education’s website School Improvement in Maryland. The checklist includes space to list the month each Key Action is began and completed, and who participates in each Key Action. This checklist includes 21 actions grouped into six steps.

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7 “About BIE: Project Based Learning.” Buck Institute for Education. http://bie.org/about
### Figure 1.3: School Improvement in Maryland Key Actions Checklist

<table>
<thead>
<tr>
<th>KEY ACTIONS</th>
<th>MONTH TAKEN</th>
<th>PARTICIPANTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BEGAN</td>
<td>COMPLETED</td>
</tr>
<tr>
<td><strong>Analyzing the Data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analyze your AYP Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analyze your MSA and/or HSA Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify questions your data raised.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify priority needs to address in the school improvement plan.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Clarifying the Problem</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collect additional data about your instructional program based on key instructional processes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypothesize root causes and contributing factors for why your data looks like it does.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collect evidence to prove or disprove selected hypotheses.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify a small number of high-impact causes to address in the school improvement plan.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Create Your Action Plan</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify annual objectives for the new school improvement plan.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify what evidence you will accept as attainment of the objective.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Based on your problem clarification findings, choose the strategies that you will implement to address your problem.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify what data you will collect to monitor progress toward the goal.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify activities that will support the strategy.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify people responsible for implementing strategies, collecting the assessment data, and monitoring overall progress.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify staff development that staff need to implement the strategies.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Implementing Your Action Plan</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Map out calendar of activities.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop a communication plan to ensure that all staff and stakeholders understand the school improvement plan and their role in attaining school goals.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Monitor Your Action Plan</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systematically and regularly collect and analyze data to assess whether progress toward attainment of objectives is satisfactory.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decide whether revisions to the plan are needed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Act on Needed Changes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decide what changes are needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communicate progress and any needed changes.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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IMPROVING CLASSROOM MANAGEMENT

In addition to supporting school wide improvement, checklists can be incorporated into improving classroom management for individual teachers. For example, a professional development model described in the journal *Beyond Behavior* promotes evidence-based classroom management strategies through a checklist of five effective strategies. These strategies were identified through a review of academic literature on classroom management. The checklist in Figure 1.4 consolidates a variety of management practices into a smaller number of broader strategies, reducing the total number of items on the checklist to a manageable number while maintaining a comprehensive checklist of effective practices.11

This checklist can be used for a classroom observation before an initial consultation meeting. During the professional development process, the teacher is trained to use the checklist as a formative self-assessment to check for implementation of best practices. In the next phase of the process, both the teacher and consultant use the checklist daily to track progress and inform feedback. The checklist is also used as a summative evaluation to determine whether the teacher has developed proficiency in applying evidence-based classroom management strategies.12

![Figure 1.4: Evidence-Based Classroom Management Strategies](image)

<table>
<thead>
<tr>
<th>STRATEGY</th>
<th>DESCRIPTION</th>
<th>APPLIED EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximize Structure</td>
<td>The teacher provides a structured learning environment that includes frequent teacher-directed activity and thoughtful physical configuration of the learning space (e.g., direct instruction, minimizing environmental distractions)</td>
<td>Mrs. Bray moved the bookcases in her classroom and reconfigured desk groupings so that she was able to see all students during whole-group and small-group instruction. The new configuration also allowed her to move around the room with ease and provided students with pathways to the pencil sharpener and bathroom that did not disturb others.</td>
</tr>
<tr>
<td>Post, teach, review, monitor, and reinforce expectations</td>
<td>Classroom/school-wide expectations are explicitly taught and referenced across settings/activities, and staff members engage in active supervision.</td>
<td>During independent work, the teacher circulates around the classroom conferring with students as they work (instead of sitting at her desk working on another project while students complete their work).</td>
</tr>
<tr>
<td>Actively engage students in observable ways</td>
<td>Provide students with many, varied opportunities to respond across all instructional formats.</td>
<td>During a whole-group direct-instruction lesson on writing equivalent fractions, the teacher provides each student with a whiteboard/dry-erase marker and asks each student to write the equivalent fraction for the fraction she has given, then hold up the board. Other examples include the use of peer tutoring, response cards, and computer-assisted instruction.</td>
</tr>
</tbody>
</table>
| Use a continuum of strategies to respond to inappropriate | Provide individual students with specific and contingent praise; implement class-wide group contingencies, individual contingencies; use behavioral contracting and/or token economies | After Julia accurately described the difference between similes and metaphors, her teacher immediately said, “Excellent, Julia! I like how clearly you explained the difference between similes and metaphors to the whole

12 Ibid., pp. 5–6.
STRATEGY | DESCRIPTION | APPLIED EXAMPLE
--- | --- | ---
Use a continuum of strategies to respond to inappropriate behavior | Provide individual students with specific and contingent error-correction statements, provide students with performance feedback, and utilize strategies that include planned ignoring, response cost, and time-out from reinforcement | During whole group mathematics instruction, Mark shouted out the correct answer to a problem that the teacher was solving at the front of the room. The teacher raised her hand (modeling the appropriate response) and calmly said, “Please remember to raise your hand when you have an answer to share.”

**FLOWCHARTS**

Flowcharts often complement checklists by displaying processes visually, with different shapes identifying different steps in a process. Flowcharts enable users to visualize a process more easily than descriptive narrative, and to compare actual processes to their desired outcomes. Flowcharts can help users to better understand a process, communicate a process to others, and to study a process for improvement. Effective flowcharts do the following:

- Develop common understandings of a process among all relevant actors,
- Communicate a process in an easily understood form,
- Compare actual to ideal paths and suggest solutions to problem areas,
- Identify areas for improvement,
- Use consistent, easily understood symbols for each step in a process,
- Include an opportunity for staff members to participate in the construction of the flowchart,
- Show connections and sequences clearly,
- Support communication, decision-making, and problem-solving,
- Build understanding of processes,
- Enable the standardization of processes, and
- Allow users to monitor and update processes.

Figure 1.5 shows a sample flowchart for a Response to Intervention (RTI) process in Grade 3 literacy, taken from a 2003 report by Education for the Future, a nonprofit school improvement organization that provides schools, districts, and other educational service providers with data analysis and capacity building services. Each decision in the process is

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13 Chart taken directly from: Ibid., p. 5.
represented by a diamond, with text indicating the criteria on which that decision is based. Rectangles indicate the steps to be taken after each decision, while arrows represent the sequence of events in the process.

Figure 1.5: Sample RTI Process Flowchart

Source: Education for the Future

School districts can also use flowcharts to ensure that best practices are implemented uniformly across a district. For example, Broward County Public Schools (FL) used the flowchart presented in Figure 1.6 to codify a memorandum of understanding related to racially disproportionate school discipline outcomes, so that all actors within a school would understand the steps required before a student can be arrested.

Figure 1.6: Broward County Public Schools Discipline Referral Flowchart

Source: Education Week

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**BUSINESS PROCESS MODELING**

Business Process Modeling (BPM) is an advanced form of flowcharting that uses modeling languages to display activities sequentially and use routing constructs to model alternative and parallel threads. BPM is commonly used in both business and software design. The most common modeling language, Business Process Modeling Notation (BPMN), includes the elements listed in Figure 1.7. Several related BPM languages, such as Event-Driven Process Chains, use similar elements.20

**Figure 1.7: Business Process Modeling Notation Elements**

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>DESCRIPTION</th>
<th>REPRESENTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Events</td>
<td>Something that happens during the lifetime of a business process.</td>
<td>Circle</td>
</tr>
<tr>
<td>Activities</td>
<td>Tasks that have to be performed</td>
<td>Rectangle with rounded corners; the flow of control or sequence flow between activities is depicted by arcs.</td>
</tr>
<tr>
<td>Gateways</td>
<td>Forking and joining paths that must be performed in parallel or alternatively</td>
<td>Diamond</td>
</tr>
</tbody>
</table>

Source: *Electronic Communications of the EASST*21

Gateways are further divided into splits (with more than one outgoing arc) and joins (with more than one incoming arc) into the types listed in Figure 1.8. Each gateway type is represented by a variation on the diamond shape.

**Figure 1.8: BPMN Gateway Types**

<table>
<thead>
<tr>
<th>GATEWAY TYPE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exclusive Gateway</td>
<td>When splitting, the sequence flows to exactly one of its outgoing branches. When joining, the gateway awaits one incoming branch being completed before triggering the outgoing flow.</td>
</tr>
<tr>
<td>Parallel Gateway</td>
<td>When splitting, the gateway activates all outgoing branches in parallel. When joining, the gateway waits for all incoming branches to complete before triggering the outgoing flow.</td>
</tr>
<tr>
<td>Inclusive Gateway</td>
<td>When splitting, some of the outgoing branches are activated. When merging, the gateway waits for all active incoming branches to complete before triggering the outgoing flow.</td>
</tr>
</tbody>
</table>

Source: *Electronic Communications of the EASST*22

Figure 1.9, on the next page, shows a sample BPMN model, of a simplified process for evaluating an application for real-estate credit in a bank. This example is drawn from a 2010 article in the journal *Electronic Communications of the EASST*.

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21 Chart contents taken with minor alterations from: Ibid., p. 2.

22 Chart contents taken with minor alterations from: Ibid.
Users can analyze BPMN flowcharts using BPMN-Q, a visual language that queries flowcharts by matching the flowchart to a query graph. This analysis can be used to ensure that processes as implemented comply with relevant regulations and standards. BPMN-Q may include the following elements:

- Variable Node: Unknown activities in a query,
- Generic Node: An unknown node in a process,
- Generic Split/Generic Join: Any type of split/join gateway,
- Negative Sequence Flow: States that there is no arc from a node A to a node B,
- Path: states that there must be a path from a node A to a node B, and
- Negative Path: States that there is no path from a node A to a node B.

MANAGEMENT PROCESSES WITH VISUALIZATIONS

In the following subsection, three models for K-12 process improvement are discussed in greater depth – the self-study process (Annenberg Center for School Reform), the “Plan, Do, Study, Act Cycle” (PDSA), and Six Sigma.

ANNENBERG CENTER FOR SCHOOL REFORM SELF-STUDY PROCESS

The Annenberg Center for School Reform at Brown University recommends that schools use its self-study process to drive continuous improvement. More specifically, it recommends that schools implement the self-study process through a School Improvement Team (SIT) consisting of six to eight members from key constituent groups such as teachers, administrators, parents, and students. The SIT should be led by a full-time SIT coordinator, and work closely with the school principal. SITs also work closely with other members of the school to develop a common understanding of school practices. SITs promote effective communications among staff through conversation protocols.

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23 Chart taken directly from: Ibid., p. 3.
The self-study cycle is applied to specific focus areas and general processes that affect all areas of the school. Focus areas may be included in state standards or decided by the district. The SIT uses the self-study cycle to develop standards of practice for each focus area, and performance indicators for each standard of practice. According to the Annenberg Center for School Reform, the effective standards of practice are:

- Establish high standards for the school,
- Emphasize the most important elements of best practices,
- Clearly articulate expectations for performance outcomes,
- Reflect a broad consensus among multiple stakeholders, and
- Include definitions or descriptions of each standard.\(^{27}\)

Once standards of practice have been established, the SIT can use a self-study cycle to evaluate the school’s overall performance and drive progress towards meeting each standard. Figure 1.10, on the next page, shows the school self-study cycle recommended by the Annenberg Center for School Reform. Schools can use this process to identify improvement strategies that meet their needs and integrate continuous improvement into everyday school processes.\(^{28}\)

![Figure 1.10: Annenberg Center for School Reform School Self-Study Cycle](chart)

Source: Annenberg Center for School Reform\(^{29}\)

The self-study process includes the development of an action plan to address areas of improvement identified by the data analysis step. Quadrants of Action, listed in Figure 1.11: Annenberg Center for School Reform Quadrants of Action on the next page, characterize school processes addressed through action plans.

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\(^{27}\) Bulleted text adapted from: Ibid., p. 11.

\(^{28}\) Ibid., pp. 3–4.

\(^{29}\) Chart adapted from: Ibid., p. 4.
**Figure 1.11: Annenberg Center for School Reform Quadrants of Action**

<table>
<thead>
<tr>
<th>QUADRANT</th>
<th>COMPONENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>I – Human Resource Use and Development</td>
<td>Skills: How staff promote student achievement</td>
</tr>
<tr>
<td></td>
<td>Knowledge: What staff knows about effective practice</td>
</tr>
<tr>
<td></td>
<td>Will and teacher expectations of students: Why staff work to promote student achievement</td>
</tr>
<tr>
<td>II – School Organization</td>
<td>Systems and structures: Length of class periods, what is taught, etc.</td>
</tr>
<tr>
<td></td>
<td>Policies and rules: School characteristics that promote a rich learning environment</td>
</tr>
<tr>
<td></td>
<td>Culture (student and adult/professional): Teacher, student, and administrator values, attitudes, and general behavior</td>
</tr>
<tr>
<td>III – Fiscal and Technical Resources</td>
<td>Resources available and allocated to the achievement of core instructional needs</td>
</tr>
<tr>
<td>IV – Social Resources</td>
<td>Partnerships: Use of community assets to increase a school’s resources</td>
</tr>
<tr>
<td></td>
<td>Parent and community connections: Relationship with families and community members who are invested in student success</td>
</tr>
</tbody>
</table>

Source: Annenberg Center for School Reform

**PLAN DO STUDY ACT CYCLE**

The Plan Do Study Act (PDSA) Cycle is a systematic process for continuous improvement and is outlined in Figure 1.12, below.

**Figure 1.12: Plan, Do, Study, Act Cycle**

- **Plan**
  - Identify a goal or purpose, formulate a theory, define success metrics, and implement the plan

- **Do**
  - Implement the components of the plan

- **Act**
  - Adjust the goal, change methods, or reformulate the theory as needed

- **Study**
  - Monitor progress to test the plan for signs of success or areas for improvement

Source: The W. Edwards Deming Institute

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30 Chart contents adapted from: Ibid., p. 18.
Schools or districts using the PDSA Cycle should take care to ensure that a root cause is identified in the plan step. According to a 2009 book by Robert W. Ewy, a strategic planning consultant for school districts, and Henry A. Gmitro, the superintendent of Community Consolidated School District 93 in Illinois, the PDSA Cycle is often less effective than Six Sigma because improvement teams move directly from identifying a problem to proposing a solution without correctly identifying the root cause of the problem.\textsuperscript{33}

The PDSA Cycle was originally designed to be used in a continuous improvement cycle for businesses.\textsuperscript{34} However, PDSA was been adapted for use in the K-12 sector. Schools can use the PDSA Cycle to analyze and improve a variety of processes, including faculty and school board meetings, conducting stakeholder surveys, and parent and community engagement. The PDSA Cycle can also be used as an instructional intervention to help individual students develop an understanding of their own learning process.\textsuperscript{35}

For example, Penn Elementary School in Prince William County, VA uses the PDSA Cycle as part of its deployment of the Balridge Quality Framework. Penn Elementary School uses the PDSA Cycle to design interventions for individual students, as well as to improve classroom routines and school-wide performance.\textsuperscript{36} Figure 1.13, on the next page, shows the version of the PDSA Cycle used by Penn Elementary School, in which the Plan step is subdivided into four steps (define the problem, assess the current situation, analyze root cause, and write an improvement theory).

\begin{flushright}
\end{flushright}
Montgomery County Public Schools and Iredell-Statesville Public Schools, profiled in Section II of this report, also incorporate the PDSA Cycle into the Balridge Quality Framework. Both districts also use the PDSA Cycle as a classroom instructional tool to help students visualize and improve their learning processes.

**SIX SIGMA**

Finally, Six Sigma is a quality control process that aims to decrease variation in business processes so that process limits are within three standard deviations of the center line in a control chart and requirements or tolerance limits are within six standard deviations of the center line. As such, Six Sigma projects are implemented by teams with training in statistical thinking. Ewy and Gmitro recommend that schools use Six Sigma over PDSA because the

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37 Chart taken directly from: Ibid., p. 2.
statistical quality tools used in Six Sigma result in a more powerful improvement process than the PDSA Cycle.39

Six Sigma teams include the project and organizational members outlined in Figure 1.14. Project-level team members function at a particular level, or Belt, determined by their level of expertise in the Six Sigma process.

**Figure 1.14: Six Sigma Roles**

<table>
<thead>
<tr>
<th>MEMBER</th>
<th>DESCRIPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Level</strong></td>
<td></td>
</tr>
<tr>
<td>White Belt</td>
<td>Works on local problem-solving teams that support projects, but is not part of a Six Sigma project team.</td>
</tr>
<tr>
<td>Yellow Belt</td>
<td>Works on a project team to review process improvements that support the project.</td>
</tr>
<tr>
<td>Green Belt</td>
<td>Collects and analyzes data for Black Belt projects and leads Green Belt projects.</td>
</tr>
<tr>
<td>Black Belt</td>
<td>Leads Black Belt projects and coaches project teams</td>
</tr>
<tr>
<td>Master Black Belt</td>
<td>Trains and coaches Black Belts and Green Belts, serves as a technologist and internal consultant, and develops key metrics and strategic direction for the Six Sigma program</td>
</tr>
<tr>
<td><strong>Organizational Support</strong></td>
<td></td>
</tr>
<tr>
<td>Champion</td>
<td>Creates an organizational deployment plan based on the organization’s vision, mission, goals, and metrics; identifies needed resources and removes obstacles</td>
</tr>
<tr>
<td>Executive</td>
<td>Aligns the strategic focus of the Six Sigma program with the organization’s culture and vision</td>
</tr>
</tbody>
</table>

Source: American Society for Quality40

Six Sigma teams improve processes using the Define, Measure, Analyze, Improve, Control (DMAIC) process outlined in Figure 1.15. The DMAIC process provides a formal method for improving processes that prevents key steps in the improvement process from being skipped.41

**Figure 1.15: Define Measure Analyze Improve Control Process**

Define the project goals and requirements  
Measure existing process performance  
Analyze the process to determine the root cause of variation in performance  
Improve process performance by addressing the root cause of variation  
Control the improved process

Source: Association for Quality42

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The most commonly used method of identifying root causes within a Six Sigma process is the fishbone diagram, also known as the cause and effect diagram, which lists potential or actual causes that lead to an effect of interest. The fishbone diagram allows project teams to brainstorm potential causes of an effect of interest in a guided manner, and is particularly useful for situations in which little quantitative data is available. Figure 1.16 shows an example of the fishbone diagram used in Montgomery County Public Schools, profiled in Section II of this report.

Figure 1.16: Montgomery County Public Schools Fishbone Diagram

![Fishbone Diagram](https://www.montgomeryschoolsmd.org/info/baldrige/staff/qualitytools/FishboneDiagram.pdf)

Although the fishbone diagram enables project teams to graphically represent potential relationships, it does not include a process to test whether the theorized causes are actually the root cause of an issue. Project teams can use the tests outlined in Figure 1.17, on the next page, drawn from the theory of constraints (TOC) system to verify root causes identified in a fishbone diagram.

---


### Figure 1.17: Root Cause Verification Tests

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>TESTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clarity</strong></td>
<td>Is the connection between cause and effect convincing at face value?</td>
</tr>
<tr>
<td></td>
<td>Is there any additional verbal explanation required for the cause and effect as written?</td>
</tr>
<tr>
<td></td>
<td>Are any intermediate steps missing?</td>
</tr>
<tr>
<td><strong>Entity Existence</strong></td>
<td>Is there a complete sentence (subject and verb)?</td>
</tr>
<tr>
<td></td>
<td>Does the sentence make sense?</td>
</tr>
<tr>
<td></td>
<td>Is it a true statement? Does it exist in reality?</td>
</tr>
<tr>
<td><strong>Causality Existence</strong></td>
<td>Does the cause, in fact, result in the effect (i.e., does an if-then connection really exist?)</td>
</tr>
<tr>
<td></td>
<td>Does it make sense when read aloud – using if-then?</td>
</tr>
<tr>
<td><strong>Cause Insufficiency</strong></td>
<td>Can the cause result in the effect on its own, or must it exist in concert with one or more other causes?</td>
</tr>
<tr>
<td><strong>Additional Cause</strong></td>
<td>Is this the only cause? Are there other independent causes that may result in the same effect?</td>
</tr>
<tr>
<td></td>
<td>If the cause in question is eliminated, are there other circumstances in which the effect would still be present?</td>
</tr>
<tr>
<td><strong>Cause-and-Effect Reversal</strong></td>
<td>Is the arrow really drawn in the proper direction? Is it possible that what is offered as the cause might really be the effect?</td>
</tr>
<tr>
<td><strong>Predicted Effect Existence</strong></td>
<td>Is the cause itself intangible? If so, are there one or more additional predicted effects that must exist for the cause-and-effect relationship to be valid</td>
</tr>
<tr>
<td><strong>Tautology</strong></td>
<td>Is it circular logic?</td>
</tr>
<tr>
<td></td>
<td>Is the effect offered as a rationale for the cause?</td>
</tr>
</tbody>
</table>

Source: iSixSigma 46

The DMAIC process can be implemented through a team approach in which members of a Six Sigma project team work on the process part-time over several months, or through the kaizen event method, in which the project team works on the DMAIC process full time over a period of approximately one week. Typically, changes to processes are piloted during the DMAIC process and implemented at scale after the process concludes. Ongoing quality monitoring ensures the effective implementation of changed processes at scale. 47
SECTION II: PROFILES

In this section, Hanover Research profiles three school districts that have achieved substantial improvement in student achievement or been publicly recognized for the quality of their process management. Adams 12 Five Star Schools (CO) uses the Six Sigma process to drive continuous improvement, while Montgomery County Public Schools (MD) and Iredell-Statesville Public Schools (NC) incorporate the Plan, Do, Study, Act (PDSA) Cycle into the Balridge Quality Framework. Montgomery County Public Schools is also in the process of implementing the Six Sigma Process.

ADAMS 12 FIVE STAR SCHOOLS

Adams 12 Five Star Schools, located in Colorado, began using the Six Sigma process in 2008 at the suggestion of a school board member with a background in manufacturing. The implementation process was led by an outside consultant and an assistant principal who already had some exposure to Six Sigma. The consultant led professional development activities to gain support for the process from teachers, using a case study of the successful application of Six Sigma in a radio company.48 Figure 2.1 shows background information for Adams 12 Five Star Schools, taken from the National Center for Education Statistics’ Common Core of Data.

Figure 2.1: Adams 12 Five Star Schools Background Information

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>INDICATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Students</td>
<td>43,268</td>
</tr>
<tr>
<td>Classroom Teachers (FTE)</td>
<td>2,085.5</td>
</tr>
<tr>
<td>Total Schools</td>
<td>56</td>
</tr>
<tr>
<td>Total Expenditures per Student</td>
<td>$9,736</td>
</tr>
</tbody>
</table>

Source: National Center for Education Statistics

The assistant principal, who was responsible for the implementation of Six Sigma within schools, familiarized teachers with the DMAIC process and used staff meetings to encourage teachers to identify the root cause of problems before proposing solutions. Adams 12 Five Star Schools began by applying Six Sigma to non-instructional processes such as building maintenance and purchasing materials, which district leaders judged to be easier than applying Six Sigma to instructional processes.

Adams 12 Five Star Schools initially applied Six Sigma to air quality within classrooms, which was tied to increased absences and asthma attacks at school, with a project team including an outside environmental specialist, a teacher and a custodian. Using the Six Sigma method, Adams 12 Five Star schools identified teachers keeping animals in their classrooms and


placing materials on top of ventilators as the root causes of the problem. After addressing these issues, air quality within classrooms improved.

Adams 12 Five Star Schools then applied the Six Sigma process to the district’s curriculum, which was not standardized across schools. The district piloted standardized textbooks for Grades 9 and 10, and was able to test all students on a unified core of knowledge at the end of the pilot year. Standardizing textbooks allowed Adams Five Star Schools to quantify performance across schools in the district, and to reduce costs by negotiating a discount on textbooks.50

MONTGOMERY COUNTY PUBLIC SCHOOLS

Montgomery County Public Schools, located in Maryland, received the Malcolm Balridge National Quality Award in 2010. In the same year, Montgomery County Public Schools was a finalist in the Broad Prize for Urban Education, and was identified as having the highest graduation rate of any large school district in the United States.51

Figure 2.2: Montgomery County Public Schools Background Information

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>INDICATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Students</td>
<td>148,780</td>
</tr>
<tr>
<td>Classroom Teachers (FTE)</td>
<td>9,884.81</td>
</tr>
<tr>
<td>Total Schools</td>
<td>207</td>
</tr>
<tr>
<td>Total Expenditures per Student</td>
<td>$17,336</td>
</tr>
</tbody>
</table>

Source: National Center for Education Statistics

Montgomery County Public Schools incorporates the PDSA Cycle into classroom process management.52 New teachers participate in a Balridge Quality Academy, which provides professional development in classroom management processes based on the Balridge Criteria for Performance Excellence.53 Figure 2.3, on the next page, presents a condensed version of a sample classroom PDSA cycle from Montgomery County Public Schools’ Quality Tools for the Classroom website.

The Quality Tools for the Classroom website includes a number of additional tools that can be used to improve processes within classrooms. These tools include:

- **Plus Deltas**: Used by individual students or a whole class to determine what is or is not working in an activity; pluses and deltas are reinforced or reviewed in follow-up sessions;
- **Consensograms**: Used by a whole class to gauge understanding, knowledge base, and feelings about a task before and after a lesson;
- **Force Field Analysis**: Used by individual students or a whole class as a root cause analysis to identify behaviors or beliefs that ‘drive’ or ‘prevent’ the attainment of objectives; users develop action plans to improve ‘preventers’;
- **Affinity Diagrams**: Used by individual students or a whole class to brainstorm and organize information and ideas into categories;
- **Surveys**: Used by a teacher or a whole class to collect information on student or stakeholder perceptions and inform decision-making;

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54 “Sample Plan, Do, Study Act.” Montgomery County Public Schools. Downloaded from: http://www.montgomeryschoolsmd.org/info/baldrige/staff/qualitytools.shtm#pdsa
Flow Charts: Used by individual students or a whole class to define, communicate, and monitor multi-step processes;

Bone Diagrams: Used by individual students or a whole class to define the current state and identify steps toward the desired state;

Issue Bins: Used by individual students to note ideas, questions, or issues while the class focuses on an activity or lesson;

Graphs: Used by individual students or a whole class to chart, organize, analyze, and display data for decision-making and recommendations; and

Action Plans: Used by individual students or a whole class to record persons responsible, timelines, resources needed, and monitoring processes for tasks that need to be completed to reach target goals.  

In addition to using the PDSA Cycle to improve processes within classrooms, Montgomery County Public Schools has adapted the PDSA Cycle to support its strategic planning process. Figure 2.4, on the next page, shows Montgomery County Public Schools’ strategic planning process.

---

Figure 2.4: Montgomery County Public Schools Strategic Planning Process

Step 1: PLAN
Validate the Need for Improvement and Clarify Purpose
- Assess organizational performance
- Review/refine vision, mission, core values, and priorities based on assessment
- Develop goals, measures, and strategic objectives that support vision, mission, core values, and priorities
- Office, department, division, and schools develop strategic plans and action plans that are aligned with the system’s plan

Step 2: DO
Align Action at all Levels of the Organization
- Strategic and action plans are deployed

Step 3: STUDY
Analyze Formative and Summative Results
- Board, F.I.T, superintendent, deputy and associate superintendents, community superintendents, directors, principals, and teachers monitor, review, evaluate progress, and recommend course correction, where necessary

Step 4: ACT
Continuous Improvement
- Focus on opportunities for improvement, based on assessments
- Redefine and redesign system, office, department, and school goals and action plans
- Redirect and redeploy resources to address opportunities for improvement

Evaluate the Process, Make Adjustments, and Repeat the Cycle

Source: Montgomery County Public Schools

Montgomery County Public Schools is in the process of implementing Six Sigma. The district has partnered with local businesses, who provide district staff with training in Six Sigma, as well as the BPM system used by Lockheed Martin to identify waste in business processes.\(^{57}\) Montgomery County Public Schools has also incorporated Six Sigma certification into its hiring qualifications for positions related to process improvement.\(^{58}\) The Six Sigma process is used to guide improvements to district-wide processes, such as school meal preparation.\(^{59}\)

**IREDELL-STATESVILLE SCHOOLS**

Iredell-Statesville Schools, located in North Carolina, adopted the Balridge Criteria for Performance Excellence, including the use of the PDSA Cycle, in 2002.\(^{60}\) The district received the Malcolm Balridge National Quality Award in 2008.\(^{61}\) Figure 2.5 shows background information for Iredell-Statesville Public Schools, taken from the Common Core of Data.

![Figure 2.5: Iredell-Statesville Public Schools Background Information](https://www.iss.k12.nc.us/page/5)

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>INDICATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Students</td>
<td>21,400</td>
</tr>
<tr>
<td>Classroom Teachers (FTE)</td>
<td>1,342.31</td>
</tr>
<tr>
<td>Total Schools</td>
<td>36</td>
</tr>
<tr>
<td>Total Expenditures per Student</td>
<td>$8,668</td>
</tr>
</tbody>
</table>

Source: National Center for Education Statistics\(^{62}\)

The PDSA Cycle was implemented as part of a district reform strategy in response to a financial crisis and low academic performance. The district hired a new superintendent with prior experience in the Balridge National Quality Program, who developed a lead-teacher system to implement the Balridge Criteria for Performance Excellence through professional development and coaching, beginning in the district’s Title I schools.\(^{63}\)

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http://www.montgomeryschoolsmd.org/uploadedfiles/about/strategicplan/ourcalltoaction.pdf

\(^{58}\) “Process Improvement Analyst.” Office of Human Resources - Montgomery County Public Schools.  


http://rube.asq.org/sections/mini-sites/0414/newsletter_200910.pdf

\(^{61}\) “About I-SS.” Iredell-Statesville Public Schools.  
http://www.iss.k12.nc.us/page/5

\(^{62}\) “Search for Public School Districts - District Detail for Iredell-Statesville Schools.” National Center for Education Statistics Common Core of Data.  
https://nces.ed.gov/ccd/districtsearch/district_detail.asp?Search=1&details=1&InstName=iredell-statesville&DistrictType=1&DistrictType=2&DistrictType=3&DistrictType=4&DistrictType=5&DistrictType=6&DistrictType=7&NumOfStudentsRange=more&NumOfSchoolsRange=more&ID=3702310

Figure 2.6 shows the version of the PDSA Cycle used in Iredell-Statesville Public Schools for large-scale strategic process improvements.

**Figure 2.6: Iredell-Statesville Public Schools PDSA Process**

- **Plan**
  - Validate the need for improvement
  - Clarify purpose, goals, and measures

- **Do**
  - Adopt and deploy an approach to continual improvement
  - Translate the approach to aligned action

- **Study**
  - Analyze results

- **Act**
  - Make improvements

Source: Iredell-Statesville Public Schools

In 2004, Iredell-Statesville Schools developed a version of the PDSA Cycle adapted for classroom use in response to complaints from teachers that the existing PDSA Cycle was too complex. The classroom PDSA Cycle is used by students to identify learning gaps and by teachers to develop classroom goals and improvement strategies. Figure 2.7, on the next page presents a sample classroom PDSA Cycle form at the elementary school level. This form can be filled in by the teacher and class as the PDSA Cycle is completed.

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64 Chart taken directly from: Ibid., p. 2.
**Figure 2.7: Iredell-Statesville Schools Sample Classroom PDSA Cycle**

<table>
<thead>
<tr>
<th>Plan</th>
<th>Do</th>
</tr>
</thead>
<tbody>
<tr>
<td>Today’s Date:_______________</td>
<td>Strategies we’ll use for the week beginning:</td>
</tr>
<tr>
<td>Our Learning Target for this week (CCSS focus):</td>
<td>____________</td>
</tr>
<tr>
<td>How and when we will measure our learning:</td>
<td>To help us reach our goal for this learning target, we will:</td>
</tr>
<tr>
<td>Our Performance Goal:</td>
<td>Play games</td>
</tr>
<tr>
<td></td>
<td>White Boards</td>
</tr>
<tr>
<td></td>
<td>Cooperative Groups</td>
</tr>
<tr>
<td></td>
<td>Or Partners</td>
</tr>
</tbody>
</table>

We will celebrate improvement by:

- Treasure Box
- Computer
- Tell the Principal
### Act

<table>
<thead>
<tr>
<th>+</th>
<th>-</th>
<th>Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td>What strategies helped us reach our goal for this learning target?</td>
<td>What kept us from reaching our goal for this learning target?</td>
<td>What should we do differently to help us improve?</td>
</tr>
</tbody>
</table>

- 
- 
- 
- 
- 

### Study

Our data chart is below.  
For the week ending:  

__________________

Did we reach our goal?  

Did we improve?  

What else does our data tell us about our progress?  

__________________

__________________

__________________

__________________

Source: Third Creek Elementary School

In 2005, Iredell-Statesville Schools developed a PDSA Cycle for use by classified staff. Interestingly, classified staff can receive pay incentives for developing process improvements (with the PDSA Cycle) that result in substantial financial savings or improvements in school outcomes. For example, a middle school bus coordinator used the PDSA Cycle to respond to an increase in bus discipline referrals by identifying areas for improvement in the discipline process and providing training in effective discipline measures to bus drivers. This resulted in a 50 percent decline in decline in disciplinary referrals related to misbehavior on buses.

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Figure 2.8 shows Iredell-Statesville Schools’ PDSA Cycle for classified staff. This version of the PDSA Cycle includes a checklist of questions and activities to be completed by classified staff over the course of an improvement process.

**Figure 2.8: Iredell-Statesville Public Schools PDSA Cycle for Classified Staff**

- **Plan**
  - What needs improving?
  - Current performance
  - Customer and requirements?
  - How is this aligned to department mission and goals?
  - What is the proposed approach to improve results?

- **Do**
  - What do you as leader need to do to implement the proposed approach?
  - What do the workers need to do?
  - What resources will be needed?
  - How will you evaluate progress?
  - Obtain approval from supervisor to conduct improvement cycle

- **Study**
  - Chart the progress on improving the outcomes listed in the Plan phase.
  - What improved? What was the impact on the customer listed in the Plan phase?
  - What were the cost savings for Iredell-Statesville Public Schools?

- **Act**
  - List what did and did not work.
  - Share results with supervisor.
  - What best practices can be transferred to another process in your department or unit?
  - Can this process be improved? If so, begin the cycle again/
  - Supervisor recommends performance pay based on results.

Source: Association for Quality

Iredell-Statesville Public Schools has witnessed substantial improvements in academic outcomes after adopting the PDSA Cycle. For example, Iredell-Statesville Public Schools’ SAT scores increased from the 57th to the 10th highest district average in North Carolina between the 2003-2004 to 2006-2007 school years. Similarly, the percent of students obtaining proficient scores on statewide reading tests increased from less than 80 percent during the 1998-1999 school year to 90 percent during the 2006-2007 school year.

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67 Chart taken directly from: Ibid.
68 Ibid., pp. 3–4.
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