Continuous Quality Improvement at DSU

August 2010
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The Higher Learning Commission (HLC) is an independent corporation and one of two commission members of the North Central Association of Colleges and Schools (NCA), which is one of six regional institutional accreditors in the United States. The Higher Learning Commission accredits degree-granting post-secondary educational institutions in the North Central* region. *(The North Central region includes Arkansas, Arizona, Colorado, Iowa, Illinois, Indiana, Kansas, Michigan, Minnesota, Missouri, North Dakota, Nebraska, Ohio, Oklahoma, New Mexico, South Dakota, Wisconsin, West Virginia, and Wyoming.)*

**HLC Criteria for Accreditation**

Institutions seeking accreditation must provide evidence that they meet and can continue to sustain the following five criteria:

**Criterion One: Mission and Integrity** - The organization operates with integrity to ensure the fulfillment of its mission through structures and processes that involve the board, administration, faculty, staff, and students.

**Criterion Two: Preparing for the Future** - The organization’s allocation of resources and its processes for evaluation and planning demonstrate its capacity to fulfill its mission, improve the quality of its education, and respond to future challenges and opportunities.

**Criterion Three: Student Learning and Effective Teaching** - The organization provides evidence of student learning and teaching effectiveness that demonstrates it is fulfilling its educational mission.

**Criterion Four: Acquisition, Discovery, and Application of Knowledge** - The organization promotes a life of learning for its faculty, administration, staff, and students by fostering and supporting inquiry, creativity, practice, and social responsibility in ways consistent with its mission.

**Criterion Five: Engagement and Service** - As called for by its mission, the organization identifies its constituencies and serves them in ways both value.

**Academic Quality Improvement Program**

The Higher Learning Commission’s Academic Quality Improvement Program (AQIP) infuses the principles and benefits of continuous improvement into the culture of colleges and universities by providing an alternative process through which an already-accredited institution can maintain its accreditation. An institution in AQIP demonstrates how it meets the Higher Learning Commission’s five criteria for accreditation and expectations through a sequence of events that align with the ongoing activities of an institution striving to improve its performance. The figure below illustrates Dakota State University’s current status in the AQIP process.
AQIP Categories: The nine AQIP Categories provide a framework that colleges and universities can use to examine their key processes to make sure they are investing energy and resources in ways that will help achieve their goals. Each AQIP Category deals with a related group of key processes and allows an institution to analyze, understand, and explore opportunities for improving these processes and the interrelationships among them. Through the analysis of processes, the Categories promote critical reflection that allows colleges and universities to share and learn from other institutions’ experience and insight. The nine AQIP categories include the following:

AQIP Category One: Helping Students Learn focuses on the design, deployment, and effectiveness of teaching-learning processes that underlie your organization’s credit and non-credit programs and courses, and on the processes required to support them.

AQIP Category Two: Accomplishing Other Distinctive Objectives addresses the key processes (separate from your instructional programs and internal support services) through which you serve your external stakeholders — the processes that contribute to achieving your major objectives, fulfilling your mission, and distinguishing yours from other educational organizations.

AQIP Category Three: Understanding Students’ and Other Stakeholders’ Needs examines how your organization works actively to understand student and other stakeholder needs.

AQIP Category Four: Valuing People explores your organization’s commitment to the development of your faculty, staff, and administrators.

AQIP Category Five: Leading and Communicating addresses how your leadership and communication processes, structures, and networks guide your organization in setting
directions, making decisions, seeking future opportunities, and communicating decisions and actions to your internal and external stakeholders.

**AQIP Category Six: Supporting Institutional Operations** addresses the organizational support processes that help to provide an environment in which learning can thrive.

**AQIP Category Seven: Measuring Effectiveness** examines how your organization collects, analyzes, distributes, and uses data, information, and knowledge to manage itself and to drive performance improvement.

**AQIP Category Eight: Planning Continuous Improvement** examines your organization’s planning processes and how your strategies and action plans help you achieve your mission and vision.

**AQIP Category Nine: Building Collaborative Relationships** examines your organization’s relationships – current and potential – to analyze how they contribute to the organization’s accomplishing its mission.

**Action Projects**: Action Projects are designed to provide a continuous series of managed activities with the successfully completed projects accumulating into a record of the institution’s quality improvement activities. The Commission asks institutions to always have underway, and share with the Commission, at least three Action Projects. When an AQIP institution completes a project, the institution then begins a new one, using the knowledge and skills gained from its earlier projects to select, shape, and define the scope. The reasons for Action Projects are threefold.

1. First, the projects are a means to:
   a. Focus institutions new to AQIP into working on three projects and demonstrate their efforts to quality improvement.
   b. Compel institutions to develop the superstructure(s) necessary to organize and oversee a quality initiative.
   c. Drive institutions to engage their faculty and staff in selection of projects and empower employees by using them on project teams.
   d. Open an avenue for peer interaction, feedback, and review beginning with the first Strategy Forum.
2. Second, Action Projects provide institutions a finite, concrete place to begin quality improvement efforts. For many institutions, the specific choice of project is less critical than the communication of a shared sense of activity, movement, and purpose.
3. Third, Action Projects allow the institution time to gather data for its Systems Portfolio, working towards an institutionally-understood summary of current processes and performance, the benchmark for future improvement efforts.

Dakota State University’s action projects (both current and retired) can be found on the Office of Institutional Effectiveness and Assessment website at [http://www.dsu.edu/academics/assessment/accreditation/action-projects.aspx](http://www.dsu.edu/academics/assessment/accreditation/action-projects.aspx). The AQIP Timeline, which includes a comprehensive list of active and completed projects is available at this link [http://www.dsu.edu/academics/assessment/accreditation/aqip-timeline.aspx](http://www.dsu.edu/academics/assessment/accreditation/aqip-timeline.aspx)
In Summer 2006, President Knowlton initiated the steps that would lead to a new planning cycle. The DSU Planning Council was convened in a retreat to begin discussions on the 2007-2012 DSU Strategic Plan. The outcomes from those discussions resulted in the formation of a Strategic Plan Committee, which met on an ongoing basis throughout the 2006-07 academic year to devise and implement the strategic planning process and write the Plan. The information below highlights the main points of the Strategic Plan and a complete copy of the 2007-2012 Strategic Plan is available at the link above.

**Vision (2012)**

DSU has a broad national reputation for providing a dynamic, information technology rich learning and research environment.

**Values and Commitments**

Dakota State University's 2007-2012 strategic plan reflects the following set of values and shared commitments to:

1. An uncompromising passion for DSU's information technology mission.
2. The use of data-informed decision making to improve and enrich the university's programs.
3. Academic research that produces, adapts and incorporates new discipline- and pedagogy-based knowledge.
4. An unwavering support for student success and learning by promoting active engagement and creative problem-solving.
5. A relentless pursuit of emerging technologies.
6. Effective communication that is open and honest.
7. A university experience that promotes an understanding of our diverse world.
8. Cutting-edge academic programs focused on its information-technology mission.

**Focus**

Through a strategic planning process, DSU has developed seven overarching goals for the University. The goals are stated in brief here and discussed more fully in later sections.

1. Expand current information technology leadership through cutting-edge programs.
2. Optimize on-campus student enrollment and enhance program quality by attracting high-ability students.
3. Increase student retention and graduation by providing an exceptional student experience.
4. Advance DSU's emphasis on applied research.
5. Extend DSU's educational outreach through online and alternative-location delivery.
6. Promote increased visibility and recognition of the University.
7. Develop new sources of revenue.
SECTION 3: PIED Cycle
Continuous Quality Improvement at DSU

Continuous quality improvement (CQI) is a comprehensive approach used by everyone at DSU to evaluate and enhance processes, programs and services and to improve student learning. It is through CQI that we maximize institutional effectiveness and support the university’s mission and strategic plan. CQI is best accomplished when decisions are data-driven and we each play an integral role in the process.

DSU Data Driven Projects – the Plan, Implement, Evaluate, Decide (PIED) cycle

Context: Projects are initiated to allow the attainment or realization of outcomes which in turn support DSU’s Strategic Plan as shown in Figure 1. The resulting effort may be relatively short-lived and simple or it may involve a long-term project with several major facets.

Figure 2. Relationship of projects to the institutional strategic plan - The big picture

The process to approach these projects is illustrated in figure 2. The Plan, Implement, Evaluate and Decide steps form the PIED-cycle. This is where the work happens. The first step is the process of recognizing and starting a new project. The PIED-cycle represents developing a plan, actually doing the work, then evaluating the consequences of that action, and communicating the results. This cycle may be carried out multiple times as the activity is piloted and refined based on the effectiveness of the efforts. Finalizing (the Decide step) includes a critical analysis of the project, reflecting on what can be learned to improve future projects, and deciding what the next step will be.
STUDENT LEARNING: Student Learning, as defined by the Student Learning Imperative, is a process by which the university creates conditions that motivate and inspire students to devote time and energy to educationally-purposeful activities, both in and outside the classroom. This is measured by students’ abilities to: (a) gain complex cognitive skills such as reflection and critical thinking; (b) apply knowledge to practical problems encountered in one’s vocation, family, or other areas of life; (c) have an understanding and appreciation of human differences; (d) exercise practical competence skills (e.g., decision making, conflict resolution); and (e) develop a coherent integrated sense of identity, self-esteem, confidence, integrity, aesthetic sensibilities, and civic responsibility. All activities at Dakota State University focus on enhancing the student learning experience, whether it be in or out of the classroom.

The process is as follows:

**Plan:**
- Define the problem or process that will be reviewed
- Define the broad goal and time frame for the project. (The strategic plan serves as a foundation for identifying and selecting which projects to pursue.)
- Identify stakeholders (e.g. external and internal)
- Assign the champions to serve as the big-picture leaders
- Review existing data that appears to be related to the outcomes
- Refine the data and outcome to clearly define the project in terms of activities
- Select managers for each of the activities
- Determine evaluation measures and set attainable target values
- Assess the relevance of the measures to corresponding institutional measures for strategic objectives and focus areas
- Identify resources that are needed (available vs. requested)
- Develop a plan for communicating progress

**Implement:**
- Finalize the detailed plans for the activities
- Assign specific duties to individuals
- Do the work
- Collect data
Evaluate:
- For each evaluation measure, analyze the data with respect to impact on outcomes and institutional strategic objectives.
- Summarize the results into a report to explain the effectiveness of the implementation process
- Review progress and analyze results of project within project team
  - Assess effectiveness of evaluation measures
  - Assess effectiveness of the process

Decide:
- Determine if the goal was achieved; reevaluate project, if necessary, based on feedback
- Document lessons learned; finalize the successful project or propose another activity to go into planning that is supported by the collected data
- Communicate progress and next steps to the campus
- Institutionalize project OR restart PIED OR discontinue project

Overall, the impetus for any project is to support outcomes which in turn support DSU’s Strategic Plan. Accordingly, a project is broadly defined with an outcome in mind. The team under the direction of the unit leadership must formalize the project through the development of the plan. To begin, the current status must be determined through evaluation of available data. This will provide the foundation to determine which activities would likely lead to the attainment of the outcome. Similarly, the evaluation of the data will allow for the setting of target data measures to track the project. Once the activities are planned, it is time to get to work and implement the activity plan. The small details will have to be worked out in order to facilitate the activity. Along the way, it is vital that data is collected and recorded. As the activity wraps up, the data is evaluated to determine what happened and how successful the efforts were. Upon careful analysis of the data, a report is produced to summarize the results of the project and to illustrate the data-informed conclusions about effectiveness. If the outcomes are achieved, the project can be sent up the chain for final review. If the data shows there is still work to be done, the plans will have to be revisited and revised and the cycle starts again. At the end of the project, the project team will determine the appropriate time to finalize the effort and wrap up the project.
SECTION 4: PIED Checklist and Steps

As you begin the PIED process, the team will move through the following steps using the CQI tools. The team should determine who will be responsible for completing each step (Responsible column) and how soon you think it will be completed (timeline column). Fill in the “date completed” column once each step is completed.

It is recommended that Teams maintain the checklist and timeline as they work through the PIED process. It is best practice to have one member of the team maintain the information.

PIED Checklist

<table>
<thead>
<tr>
<th>Steps</th>
<th>Person Responsible</th>
<th>Timeline / Tool</th>
<th>Date Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before you begin, download a new PIED worksheet.</td>
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<tr>
<td>1. Plan Step</td>
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<td>Tool:</td>
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<tr>
<td></td>
<td>Identify and complete the Tool(s) used to Plan</td>
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<tr>
<td>2. Implement Step</td>
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<td>Tool:</td>
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<tr>
<td></td>
<td>Identify and complete the Tool(s) used to Implement</td>
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<tr>
<td>3. Evaluate Step</td>
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<td>Tool:</td>
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<tr>
<td></td>
<td>Identify and complete the Tool(s) used to Evaluate</td>
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<tr>
<td>4. Decide Step</td>
<td></td>
<td>Tool:</td>
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<td></td>
<td>Identify and complete the Tool(s) used to Decide</td>
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</tbody>
</table>

**Plan**: Typical Tools--Brainstorming, Affinity Diagram, Check Sheet, Fishbone, Flowchart, Gantt Chart, Check Sheet, Data Points

**Implement**: Typical Tools--Flow Chart, Gantt Chart, Check Sheet, Data Points, other project management methods.

**Evaluate**: Typical Tools--Check Sheet, Flow Chart, Data Points

**Decide**: Typical Tools--Affinity Diagram, Brainstorming, Fishbone, Flow Chart
Step 1: PLAN

Purpose: Identify a Problem or Select a Process that will be Reviewed and Improved

If this issue affects more than one functional unit, then directors / managers need to be involved at the start.

1) Select the problem/ process that will be addressed and describe the improvement opportunity.
   a. Look for changes in important business indicators
   b. Assemble and support the right team
   c. Review customer data
   d. Narrow down project focus and develop project purpose statement

2) Describe the current process surrounding the improvement opportunity.
   a. Select the relevant process or process segment to define the scope of the project
   b. Describe the process under study

3) Describe all of the possible causes of the problem and agree on the root cause(s):
   a. Identify and gather helpful facts and opinions on the cause of the problem
   b. Confirm opinions on root causes(s) with data, whenever possible

4) Develop an effective and workable solution and action plan, including targets for improvement.
   a. Define and rank solutions (eg. activities)
   b. Plan the change process: What? Who? When?
   c. Do contingency planning when dealing with new and risky plans
   d. Set targets for improvement and establish monitoring methods

NOTES:
Typical Tools: Brainstorming, Checksheet, Affinity Diagram

Champion: The Champion should keep the Tools and Data from the PLAN step, including the ideas that are not selected, in case further planning is needed.

At this point in the PIED Process (Step 1 Plan), the champion and team should complete the first section of the PIED worksheet (highlighted in blue below). See Appendix E for a blank worksheet.
# PIED WORKSHEET – Step 1

<table>
<thead>
<tr>
<th>College/Functional Unit:</th>
<th>Champion(s):</th>
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<tr>
<th>Strategic Focus:</th>
<th>Tool(s):</th>
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<tr>
<th>Team Members:</th>
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</table>

## Based on the answers to questions in Step 1, set a broad goal, timeframe, target and evaluation measure below.

<table>
<thead>
<tr>
<th>Problem/Process: Brief description of the issue (e.g. 30% pass rate)</th>
<th>Goal and Timeframe</th>
<th>What is the current status/challenge?</th>
<th>Baseline and Target What does a realistic improvement look like (e.g. 55% pass rates)</th>
<th>Evaluation Measure: What measures will be used to determine if outcome met?</th>
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The following section should be completed for each project or activity.

<table>
<thead>
<tr>
<th>Plan Project /Activity / Implementation strategy</th>
<th>Person(s) Responsible</th>
<th>Planned target and end date</th>
<th>Implement: Actual start date and end date</th>
<th>Data and Data Collection plan</th>
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<table>
<thead>
<tr>
<th>Stakeholders:</th>
<th>Resources:</th>
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</table>

<table>
<thead>
<tr>
<th>Communication of the problem and plan:</th>
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</table>

<table>
<thead>
<tr>
<th>Evaluate: Activity</th>
<th>Summary of data collected</th>
<th>Did you meet your target?</th>
<th>Is the solution having the intended effect? Are the measures valid?</th>
<th>Any unintended consequences?</th>
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<th>Decision (institutionalize, restart PIED, or discontinue):</th>
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<th>Communication of the decision:</th>
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Note: If an activity or project is institutionalized, it needs to be added to procedures / office calendar.
Step 2: IMPLEMENT

Purpose: Finalize the plans for implementing the solution or process change

Create an implementation Strategy (the implementation strategy includes how the change will be communicated, implemented, and evaluated):

- Finalize the detailed plans for the activities
- Assign specific duties to individuals
- Do the activities / work
- Collect the data (monitor the milestones and measures)
- Communicate the change: Be sure to include all of the offices that are impacted by this activity

At this point in the PIED cycle (Step 2 Implement), the champion and team should complete the Implement section of the PIED worksheet (highlighted in blue below). If you have multiple activities linked to this project, then you will need to complete the highlighted section for each activity.

PIED Worksheet – Step 2

<table>
<thead>
<tr>
<th>Plan Project / Activity / Implementation strategy</th>
<th>Person(s) Responsible</th>
<th>Planned target and end date</th>
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</table>

Stakeholders:

Resources:

Communication of the problem and plan:

Evaluate: Activity

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<tr>
<th>Summary of data collected</th>
<th>Did you meet your target?</th>
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</table>

Decision (institutionalize, restart PIED, or Discontinue):

Communication of the decision:

Note: If an activity or project is institutionalized, it needs to be added to procedures / office calendar.
**Step 3: EVALUATE**

**Purpose:** Review and evaluate the results of the project / process change

- For each evaluation measure, analyze data with respect to impact on outcomes
- Summarize results
- Assess effectiveness of evaluation measures and process

Review and evaluate the results of the change: *(Evaluation includes collecting and evaluating data to check whether the change has helped you reach your goal.)*

1. Do we need to reevaluate our initial goal? Explain.
2. Should any of the improvements/ **activities** be changed / eliminated based on the data analysis?
3. Should any additional improvements be made to the process? Do we need to revise the materials/method we are using?

At this point in the PIED cycle (Step 3 Evaluate), the champion and team should complete the Evaluate section of the PIED worksheet (highlighted in blue below). If you have multiple activities linked to this project, then you will need to complete the highlighted section for each activity.

**PIED Worksheet – Step 3**

<table>
<thead>
<tr>
<th>Plan Project /Activity / Implementation strategy</th>
<th>Person(s) Responsible</th>
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<td>Evaluate: Activity</td>
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<td>Communication of the decision:</td>
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Note: If an activity or project is institutionalized, it needs to be added to procedures / office calendar.
Step 4: DECIDE

**Purpose:** Assess the results and problem-solving process / project and recommend changes

- Assess the results and problem-solving process and recommend changes
- Continue the improvement process where needed; standardization where possible

Was the goal achieved?

Do you **recommend changing any policies or procedures as** a result of the changes you’ve implemented?

Do you recommend another project / process change which is supported by the collected data?

How do you plan to **communicate** the results to staff and stakeholders?

What might you have done to get better results?

Were there:

- Unintended consequences or benefits?
- Barriers or bridges to success?
- Assumptions during the planning process that proved to be invalid?

DECISION and FUTURE PLANS: (choose one)

- _____ Institutionalize (Note: If institutionalized, add to procedures / office calendar)
- _____ Restart PIED
- _____ Discontinue project

At this point in the PIED cycle (Step 3 Evaluate), the champion and team should complete the Evaluate section of the PIED worksheet (highlighted in blue below). If you have multiple activities linked to this project, then you will need to complete the highlighted section for each activity.
## PIED Worksheet – Step 4

The following section should be completed for each project or activity.

<table>
<thead>
<tr>
<th>Plan Project /Activity / Implementation strategy</th>
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Stakeholders:
Resources:
Communication of the problem and plan:

### Evaluate: Activity

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<tr>
<th>Summary of data collected</th>
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### Decision (institutionalize, restart PIED, or discontinue):

Communication of the decision:

Note: If an activity or project is institutionalized, it needs to be added to procedures / office calendar.
Appendix A: Pilot Project
Appendix B: Glossary

Academic Quality Improvement Program (AQIP): The Higher Learning Commission’s Academic Quality Improvement Program infuses the principles and benefits of continuous improvement into the culture of colleges and universities by providing an alternative process through which an already-accredited institution can maintain its accreditation. An institution in AQIP demonstrates how it meets accreditation standards and expectations through a sequence of events that align with the ongoing activities of an institution striving to improve its performance.

Balanced Scorecard (BSC): The Balanced Scorecard was developed to record and track progress relative to DSU’s 2007-2012 Strategic Plan (and future strategic plans). Each unit / college uses the web-based Balanced Scorecard (BSC) to submit their institutional effectiveness plans and annual updates. More information is available at this link: [http://www.dsu.edu/academics/assessment/institutional-effectiveness/balanced-scorecard.aspx](http://www.dsu.edu/academics/assessment/institutional-effectiveness/balanced-scorecard.aspx)

Champion: Person who assumes responsibility for a project / process.

Continuous Quality Improvement (CQI): A management approach to improving and maintaining quality that emphasizes internally driven and relatively continuous assessments of potential causes of quality defects (in products or services), followed by action aimed either at avoiding a decrease in quality or else correcting it at an early stage.

CQI at DSU: Continuous quality improvement (CQI) is a comprehensive approach used by everyone at DSU to evaluate and enhance processes, programs and services and to improve student learning. It is through CQI that we maximize institutional effectiveness and support the university’s mission and strategic plan. CQI is best accomplished when decisions are data-driven and we each play an integral role in the process.

Institutional effectiveness (IE): Institutional effectiveness is a systematic, documented process of measuring performance against mission in all aspects of the university. The approach to institutional effectiveness includes all programs, services, and constituencies and is strongly linked to the decision-making process at all levels, including the budget process. The University’s institutional effectiveness process ensures that the Strategic Plan is implemented and evaluated. In 2004, DSU formed the Institutional Effectiveness Committee with representatives from the three colleges and each functional unit. Following the unveiling of the new 2007-2012 Strategic Plan in Fall 2007, the Institutional Effectiveness Committee began a series of brainstorming sessions to help the University’s functional units develop their internal goals, objectives and activities in support of the strategic plan.

Plan Do Check Act (PDCA) Cycle: PLAN what you want to accomplish over a period of time and what you might do, or need to do to get there. DO what you planned on doing. Start on a small scale! CHECK the results of what you did to see if the objective was achieved. ACT on the information. If you were successful, standardize the plan, otherwise continue in the cycle to plan for further improvement.(memory jogger page 2)

Stakeholders: Stakeholders are internal or external individuals or groups with an interest in the college’s activities.

- **Internal stakeholders** are part of the university. Their actions come from within the college. This group includes students, faculty, staff, administrators, parents/guardians etc.

- **External stakeholders** are those affected by the college’s decisions and activities, but who are not formally part of the college. This group includes community groups, educational institutions and other private/public entities (e.g. BOR, NCATE, DOE, Alumni, Madison, legislature, DSU Foundation etc.).
Strategic Plan Terms:

Strategic planning is an organization's process of defining its strategy, or direction, and making decisions on allocating its resources to pursue this strategy, including its capital and people. Various business analysis techniques can be used in strategic planning, including SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats). All strategic planning deals with at least one of three key questions: (1) "What do we do?"; (2) "For whom do we do it?"; and (3) "How do we excel?" Dakota State University undergoes a strategic planning process on a five-year cycle, using input from both internal and external stakeholders.

Focus

A strategic focus identifies a major area in which the university will concentrate its efforts and resources within a pre-set timeframe. DSU Example: Strategic Focus #1: Focus On Expanding Information Technology Leadership

Goals

A goal is stated in general terms and includes a long-term purpose. A goal is expressed in a manner that allows for future assessment of whether it was achieved. Goals can involve work products, or work processes, that have impact on improved student learning and success. DSU Example: Sustain DSU’s cutting-edge position as an elite information technology institution

Objectives

Objectives describe how a stated goal will be met. Objectives are measurable and include action verbs, such as write, list, analyze, solve, discuss, etc. DSU Example: Emphasize current information technology niches such as programs in information assurance and security for the banking and finance industry, IT-based entrepreneurship, biometrics, information systems in healthcare, computer gaming, digital arts and design, and support for mobile computing initiatives in the K-12 environment

Evaluation measures

Evaluation measures are methods to measure the outcomes. DSU Example: Number of new programs

Standards of performance

A standard of performance includes specific criteria or benchmarks that should be met. DSU Example: By 2012, DSU will have three new cutting-edge graduate programs and five new cutting-edge undergraduate degree programs that reflect the institution’s strong focus on its information-technology mission.
Example from 2007-2012 Strategic Plan:

**FOCUS:** Strategic Focus #1: Focus On Expanding Information Technology Leadership

**GOAL:** Sustain DSU's cutting-edge position as an elite information technology institution.

**OBJECTIVE:** Emphasize current information technology niches such as programs in information assurance and security for the banking and finance industry, IT-based entrepreneurism, biometrics, information systems in healthcare, computer gaming, digital arts and design, and support for mobile computing initiatives in the K-12 environment.

**Evaluation Measure** – Number of new programs

**Standards of Performance** - By 2012, DSU will have three new cutting-edge graduate programs and five new cutting-edge undergraduate degree programs that reflect the institution's strong focus on its information-technology mission.

**Student Learning** - process by which the university creates conditions that motivate and inspire students to devote time and energy to educationally-purposeful activities, both in and outside the classroom. This is measured by students’ abilities to: (a) gain complex cognitive skills such as reflection and critical thinking; (b) apply knowledge to practical problems encountered in one’s vocation, family, or other areas of life; (c) have an understanding and appreciation of human differences; (d) exercise practical competence skills (e.g., decision making, conflict resolution); and (e) develop a coherent integrated sense of identity, self-esteem, confidence, integrity, aesthetic sensibilities, and civic responsibility. (Source: The Student Learning Imperative).
Appendix C: Tools for Continuous Improvement and Effective Planning

In this section of the Dakota State University CQI Handbook, we have attempted to include some guidelines in establishing the project team, carrying out the team’s meetings, and tools to assist in the process. An important part of the planning process is selecting the right tool for the situation. The following chart may help in determining the best tool for the project or process your team is reviewing. (Links to additional resources are included at the end of this section.)

Table 1: Quick Tool Reference Guide

<table>
<thead>
<tr>
<th>WORKING IN TEAMS</th>
<th>Plan</th>
<th>Implement</th>
<th>Evaluate</th>
<th>Decide</th>
</tr>
</thead>
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<tr>
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<tr>
<td>Starting Teams</td>
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<tr>
<td>Maintain Momentum</td>
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<td>Ending Projects</td>
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<td>Effective Meetings</td>
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</tbody>
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<table>
<thead>
<tr>
<th>WORKING WITH IDEAS</th>
<th>Plan</th>
<th>Implement</th>
<th>Evaluate</th>
<th>Decide</th>
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<tbody>
<tr>
<td>Affinity</td>
<td>⭐</td>
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<td></td>
<td>⭐</td>
</tr>
<tr>
<td>Brainstorming</td>
<td>⭐</td>
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<td></td>
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</tr>
<tr>
<td>Fishbone (cause &amp; effect)</td>
<td>⭐</td>
<td>⭐</td>
<td></td>
<td>⭐</td>
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<tr>
<td>Flowchart</td>
<td>⭐</td>
<td>⭐</td>
<td>⭐</td>
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<tr>
<td>Gantt Chart</td>
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<table>
<thead>
<tr>
<th>WORKING WITH NUMBERS</th>
<th>Plan</th>
<th>Implement</th>
<th>Evaluate</th>
<th>Decide</th>
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</thead>
<tbody>
<tr>
<td>Check Sheet (counting)</td>
<td>⭐</td>
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<td></td>
<td>⭐</td>
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<tr>
<td>Data Points (counting, measures)</td>
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PROBLEM-SOLVING / PROCESS IMPROVEMENT MODEL

There are many models for making improvements, all of which attempt to provide a repeatable set of steps that a team or individual can learn and follow. At Dakota State University, the problem-solving and process improvement model used is PIED, (Plan, Implement, Evaluate, Decide). (See Section 2 of this Handbook.)

Some suggested tools that might be of assistance to teams in each of these steps are contained in this section of the DSU CQI Handbook. Below are some suggested tools for use in each of the PIED steps:

**Plan** – Brainstorming, Affinity Diagram, Check Sheet, Fishbone, Flowchart, Gantt Chart, Check Sheet, Data Points

**Implement** – Flow Chart, Gantt Chart, Check Sheet, Data Points, other project management methods.

**Evaluate** – Check Sheet, Flow Chart, Data Points

**Decide** – Affinity Diagram, Brainstorming, Fishbone, Flow Chart

TEAM GUIDELINES

Starting Teams

The highest priority for any team is to establish its purpose, process and measures of team progress. Once the team has developed guidelines and charters specific to its purpose, they should be recorded and posted at each team meeting for reference.

- **Team Behavior Charter**
  - Ground rules – Set ground rules for acceptable and unacceptable individual and team behavior.
  - Decision-making – Will decisions be made by consensus, majority rule, or anarchy? Discuss whether there are, or should be, exceptions to the team’s usual process.
  - Communication – Value listening and constructive feedback and make the effort, every day, to communicate constructively.
  - Roles and participation – Discuss how to choose a team leader and generally how the team process will be led. Everyone must take responsibility to encourage equal participation.
  - Values – Acknowledge and accept the unique insight of each member of the team.

- **Purpose Charter**
  - Establish reason why the team exists.
  - Bring together individuals who work well together. Determine whether each person has the knowledge, skills, and influence required to participate effectively on the team.
  - Discuss who its customers are. If multiple customers are involved, decide which customers have highest priority or at least how their needs will be balanced.

- **Measures of Team Progress**
  - Discuss and agree on desired signals which the team can assess both objectively and subjectively, that will indicate the team is making progress.
  - Discuss and agree on the types of measures and outcomes that will indicate the team has reached success or failure.
  - Estimate the date for project completion.

Maintaining Momentum
A real challenge is keeping a team focused on its purpose and not the histories of its members and their relationships to one another.

- **Agree on the improvement model to use**
  - DSU follows the PIED cycle. (See Section 2)
  - Data. Gather relevant data to analyze the current situation. Define what you know, and what you need to know, but know when to stop. Learn when to say your work is good enough to proceed to the next step in the process.
  - Develop a plan. Use the PIED model to provide the overall structure of a project plan. Estimate times for each step and for the overall project. Monitor and revise the plan as needed.

- **Manage Team Dynamics**
  - Use facilitators. A facilitator is someone who monitors and helps team members keep their interactions positive and productive. A facilitator can help the team stay focused on its purpose while improving its working relationship.
  - Manage conflict. As teams grow, so do conflicts. This is a natural process as communication becomes more open. The entire team can learn techniques for conflict resolution and use the facilitator as a resource.
  - Recognize agreement. Managing agreement is often as much effort as managing disagreement. Test for agreement often and write down the points of agreement as they occur.
  - Encourage fair participation. Each team member must eventually take responsibility for participating consistently in all discussions. Likewise, the entire team should be constantly working to “pull back” the dominant members and draw out the quieter members.

**Ending Teams / Projects**

Most teams and all projects must eventually end. Both often end in unsatisfactory ways or don’t “officially end” at all. Before ending, the team should review the following checklist:

- We checked our results against our original goals and customer needs.
- We identified any remaining tasks to be done.
- We established responsibility for monitoring the change over time.
- We documented and trained people, when necessary, in the new process.
- We communicated the changes to everyone affected by them.
- We reviewed our own team’s accomplishments for areas of improvement.
- We celebrated the efforts of the team with a lunch, newsletter article, special presentation to the company, or other expression of celebration.
- We feel proud of our contribution and accomplishments, our new capabilities, and our newly defined relationships with coworkers.
Conducting Effective Meetings

Preparation:

- Decide on the purpose of the meeting
- Develop a meeting plan (who, what, where, when, how many)
- Identify the meeting leader (champion of project)
- Prepare and distribute the agenda (see Appendix E for a sample agenda format)
- Set up the meeting area

Beginning:

- Start on time
- Introduce the meeting leader (champion)
- Allow team members to introduce themselves
- Ask for a volunteer timekeeper
- Ask for a volunteer recorder
- Review, change, order the agenda
- Establish time limits
- Review prior meeting action items

Meeting Etiquette:

- Raise your hand and be recognized before speaking
- Be brief and to the point
- Make your point calmly
- Keep an open mind
- Listen without bias
- Understand what is said
- Avoid side conversations
- Respect other opinions
- Avoid personal agendas
- Come prepared to do what's good for the university
- Have fun

Ending:

- Develop action items (who, what, when, how)
- Summarize the meeting with the group
- Establish the date and time for a follow-up meeting
- Evaluate the meeting
- End of time
- Clean the meeting area

Next Steps:

- Prepare and distribute the meeting activity report (see Appendix E for sample meeting minutes format)
- Follow up on action items
- Go to “Preparation”
**AFFINITY DIAGRAM** (gathering and grouping ideas)

An affinity diagram is a widely-used quality tool that allows a team to creatively generate a large number of ideas and then organize and summarize natural groupings among them to understand the essence of a problem and to reach consensus on solutions.

**What does it do?**

- Encourages creativity by everyone at all phases of the process
- Breaks down long-standing communication barriers.
- Encourages non-traditional connections among ideas/issues.
- Allows breakthroughs to emerge naturally, even on long-standing issues.
- Encourages “ownership” of results because team creates both the detailed input and general results.
- Overcomes “team paralysis” which is brought on by an overwhelming array of options and lack of consensus.

**What resources are needed?**

- Felt-tip markers and post-its for each team member
- Flip chart paper on large blank wall (using flip chart paper during the organizing of the post-it notes allows team to save final results of sorting process)

**Steps**

1. Phrase the issue under discussion in a full sentence. *(From the start, reach consensus on the choice of words you will use. Neutral statements work well, but positive, negative, and solution-oriented questions also work.)*
   a. Follow guidelines for brainstorming.
   b. Record each idea on a Post-it note in bold, large print to make it visible 4-6 feet away. Use at minimum, a noun and a verb. Avoid using single words. Four to seven words work well.
2. Brainstorm at least 20 ideas or issues *(A typical affinity has 40-60 items; it is not unusual to have 100-200 ideas.)*
   a. Follow guidelines for brainstorming.
   b. Record each idea on a Post-it note in bold, large print to make it visible 4-6 feet away. Use at minimum, a noun and a verb. Avoid using single words. Four to seven words work well.
   c. Without talking, sort ideas simultaneously into 5-10 related groupings. *(Sort in silence to focus on the meaning behind ideas, instead of emotions. It is OK for some notes to stand alone.)*
      a. Move Post-it notes where they fit best for you; don’t ask, simply move any notes that you think belong in another grouping.
      b. Sorting will slow down or stop when each person feels sufficiently comfortable with the groupings.
3. For each grouping, create summary or header cards using consensus. *(Take the time needed to capture the essence of all ideas in each grouping. Shortcuts can greatly reduce the effectiveness of the final Affinity Diagram.)*
   a. Gain a quick team consensus on a word or phrase that captures the central idea/theme of each grouping; record it on a Post-it note and place it at the top of each grouping. These are draft header cards.
   b. For each grouping, agree on a concise sentence that combines the grouping’s central idea and what all of the specific post-it notes add to that idea; record it and replace the draft version. This is a final header card.
   c. Divide large groupings into subgroups as needed and create appropriate subheaders.
   d. Draw the final affinity diagram connecting all finalized header cards with their groupings.
BRAINSTORMING

Brainstorming is used to establish a common method for a team to creatively and efficiently generate a high volume of ideas on any topic by creating a process that is free of criticism and judgment. There are two major methods of brainstorming: structured and unstructured. Either process can be done silently or aloud.

What does it do?

- Encourages open thinking when a team is stuck in “same old way” thinking
- Gets all team members involved and enthusiastic so that a few people don't dominate the whole group.
- Allows team members to build on each other’s creativity while staying focused on their joint mission.

What resources are needed?

- Felt-tip markers
- Flip chart paper

Structured brainstorming: A process in which each team member gives ideas in turn.

1. The central brainstorming question is stated, agreed on, and written down for everyone to see. *(Be sure everyone understands the question or issue.)*
2. Each team member, in turn, gives an idea. No idea is criticized—ever! *(During the rotation, any member can pass at any time.)*
3. As ideas are generated, write each one in large, visible letters on a flipchart or other writing surface. *(Record ideas in the same words of speaker, don't interpret or abbreviate.)*
4. Ideas are generated in turn until each person passes, indicating that the ideas (or members) are exhausted. *(Keep process moving and relatively short—5 to 20 minutes, depending on how complex the topic is.)*
5. Review the written list of ideas for clarify and to discard any duplicates.

Unstructured brainstorming: A process in which team members give ideas as they come to mind. The process used is the same as in the structured method except that ideas are given by everyone at any time. There is no need to “pass” since ideas are not solicited in rotation.
**FISHBONE DIAGRAM (Cause and Effect)**

This process allows a team to identify, explore, and graphically display, in increasing detail, all of the possible causes related to a problem or condition to discover its root causes(s). This process helps the team focus on causes, not symptoms of the problem.

**What does it do?**

- Enables team to focus on the content of the problem, not on the history of the problem or differing personal interests of team members.
- Creates a snapshot of the collective knowledge and consensus of a team around a problem. This builds support for the resulting solutions.
- Focuses the team on causes, not symptoms.

**What resources are needed?**

- Flip charts (easier to save end result) or white board
- Felt-tip markers

**Steps**

1. Select the most appropriate cause & effect format:
   a. Dispersion Analysis-constructed by placing individual causes within each "major" cause category and then asking of each individual cause “Why does this cause (dispersion) happen?” This question is repeated for the next level of detail until the team runs out of causes.
   b. Process Classification-uses the major steps of the process in place of the major cause categories. The root cause questioning process is the same as the Dispersion Analysis type.

2. Generate the causes needed to build a Cause & Effect Diagram. Choose one method:
   a. Brainstorming without previous preparation
   b. Check Sheets based on data collected by team members before the meeting.

3. Construct the Cause & Effect / Fishbone Diagram
   a. Place the problem statement in a box on the right-hand side of the writing surface, allowing plenty of space. *(Make sure everyone agrees on the problem statement.)*
   b. Draw major cause categories or steps in the production or service process. Connect them to the “backbone” of the fishbone chart. *(There is no perfect number of categories. Make them fit the problem.)*
   c. Place the brainstormed or data-based causes in the appropriate category. *(If ideas are slow in coming, use the major cause categories as catalysts, e.g., “What in ‘materials’ is causing…?”)*
   d. Ask repeatedly of each cause listed on the “bones”, either:
      - “Why does it happen?” or
      - “What could happen?”
   e. Interpret or test for root cause(s) by one or more of the following:
      - Look for causes that appear repeatedly within or across major cause categories.
      - Select through either an unstructured consensus process or one that is structured.
      - Gather data through check sheets or other formats to determine the relative frequencies of the different causes.
Sample Fishbone:

```
Machinery / Equipment  
Unreliable cars  
Ovens too small  
Poor handling of large orders  
Methods

People

Drivers get lost  
People don't show up  
Low pay  
High turnover  
Materials

Methods

Poor dispatching  
Run out of ingredients
```

FLOWCHART

Developing a flowchart allows a team to identify the actual flow or sequence of events in a process that any product or service follows. Flowcharts can be applied to anything from the travels of an invoice or the flow of materials, to the steps in making a sale or servicing a product.

What does it do?

- Shows unexpected complexity, problem areas, redundancy, unnecessary loops, and where simplification and standardization may be possible.
- Compares and contrasts the actual versus the ideal flow of a process to identify improvement opportunities.
- Allows a team to come to agreement on the steps of the process and to examine which activities may impact the process performance.
- Identifies locations where additional data can be collected and investigated.
- Serves as a training aid to understand the complete process.

What resources are needed?

- Flip chart or white board
- Markers
Steps

1. Determine the frame or boundaries of the process.
   a. Clearly define where the process under study starts (input) and ends (final output).
   b. Team members should agree to the level of detail they must show on the Flowchart to clearly understand the process and identify problems areas.
   c. The Flowchart can be a simple macro-flowchart showing only sufficient information to understand the general process flow or it might be detailed to show every finite action and decision point. The team might start out with a macro-flowchart and then add in detail later or only where it is needed.

2. Determine the steps in the process. Brainstorm a list of all major activities, inputs, outputs, and decisions on a flipchart from the beginning of the process to the end.

3. Sequence the steps. Arrange the steps in the order they are carried out. Use Post-it notes so you can move them around. Don’t draw in the arrows yet. *(Unless you are flowcharting a new process, sequence what IS, not what SHOULD BE or the ideal.)*

4. Draw the Flowchart using the appropriate symbols.

   ![Oval](image)
   An oval is used to show materials, information or action (inputs) to start the process or to show the results at the end (output) of the process.

   ![Box](image)
   A box or rectangle is used to show a task or activity performed in the process. Although multiple arrows may come into each box, usually only one output or arrow leaves each activity box.

   ![Diamond](image)
   A diamond shows those points in the process where a yes/no question is being asked or a decision is required.

   ![Circle](image)
   A circle with either a letter or a number identifies a break in the Flowchart and is continued elsewhere on the same page or another page.

   ![Arrows](image)
   Arrows show the direction or flow of the process.
- Keep the Flowchart simple, using the basic symbols.
- Be consistent in the level of detail shown.
- Label each process step using words that are understandable to everyone.
- Add arrows to show the direction of the flow or steps in the process. *(Although not a rule, if you show all “yes” choices branching down and “no” choices branching to the left, it is easier to follow.)*
- Don’t forget to identify your work by including the title of your process, the date the diagram was made, and the names of the team members.

5. Test the Flowchart for completeness.
   a. Are the symbols used correctly?
   b. Are the process steps identified clearly?
   c. Make sure every feedback loop is closed, i.e., every path takes you either back to or ahead to another step.
   d. Check that every continuation point has a corresponding point elsewhere in the Flowchart or on another page of the Flowchart.
   e. There is usually only one output arrow out of an activity box. If there is more than one arrow, you may need a decision diamond.
   f. Validate the Flowchart with people who are not on the team and who carry out the process actions. Highlight additions or deletions they recommend. Bring these back to the team to discuss and incorporate into the final Flowchart.

6. Finalize the Flowchart.
   a. Is this process being run the way it should be?
   b. Are people following the process as charted?
   c. Are there obvious complexities or redundancies that can be reduced or eliminated?
   d. How different is the current process from an ideal one? Draw an ideal Flowchart and compare the current versus the ideal to identify discrepancies and opportunities for improvements.

The following simple Flowchart shows areas of responsibility and the flow of the process steps or tasks they are assigned.
GANTT CHART

Gantt charts are good project management tools for analyzing and planning complex projects. They can help you plan out the tasks that need to be completed and give you a basis for scheduling the timeframe for the tasks. They can also help in planning for the allocation of resources needed to complete the project and help you to work out the critical path for a project that must be completed by a particular date.

What does it do?

- All team members have a chance to give a realistic picture of what their piece of the plan requires, based on real experience.
- Everyone sees why he or she is critical to the overall success of the project.
- Unrealistic implementation timetables are discovered and adjusted in the planning stage.
- The entire team can think creatively about how to shorten tasks that are bottlenecks.
- The entire team can focus its attention and scarce resources on the truly critical tasks.
What resources are needed?

- Flip charts or white board
- Markers
- Post-its

Steps

1. Assemble the right team of people with firsthand knowledge of the subtasks.
2. Brainstorm or document all the tasks needed to complete a project. Record each on post-its.
3. Find the first task that must be done, and place the card on the extreme left of a large work surface.
4. Ask “Are there any tasks that can be done simultaneously with task #1? If there are simultaneous tasks, place the task card above or below task #1. If not, go to the next step.
5. Ask, “What is the next task that must be done? Can others be done simultaneously?” Repeat this questioning process until all the recorded tasks are placed in sequence and in parallel. (At each step always ask, “Have we forgotten any other needed tasks that could be done simultaneously?”)
6. Number each task, draw the connecting arrows, and agree on a realistic time for the completion of each task. Record the completion time on the bottom half of each post-it. (Be sure to agree on the standard time unit for each task—days, weeks, etc.)
7. Determine the project’s total completion time.

A sample Gantt Chart is shown below.

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>June</th>
<th>July</th>
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</thead>
<tbody>
<tr>
<td>Define problem to be reviewed &amp; appoint team</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
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</tr>
<tr>
<td>Gather data</td>
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<td></td>
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</tr>
<tr>
<td>Analyze data and form solutions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implement solutions</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Evaluate implementation results</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Decide on additional improvements</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Turn project over to “home” department</td>
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</tbody>
</table>
CHECK SHEET

A check sheet allows a team to systematically record and compile data from historical sources, or observations as they happen, so that patterns and trends can be clearly detected and shown.

What does it do?

- Creates easy-to-understand data that come from a simple, efficient process that can be applied to any key performance areas.
- Builds, with each observation, a clearer picture of “the facts” as opposed to the opinions of each team member.
- Forces agreement on the definition of each condition or event (every person has to be looking for and recording the same thing).
- Makes patterns in the data become obvious quickly.

What resources are needed?

- Computer (if using electronic spreadsheet or table format)
- Flipchart (if sing manual-produced table format) and markers
- Collected data

Steps

1. Agree on the definition of the events or conditions being observed. Examples include the following:
   a. If you are looking for reasons for late payments, agree on the definition of “late”.
   b. If you are tracking athletic recruiting calls from various regions, make sure everyone knows which counties are in each region.

2. Decide who will collect the data, over what period, and from what sources. *(It must be safe to record and report “bad news”, otherwise the data will be filtered.)*
   a. Who collects the data obviously depends on the project and resources. The collection period can range from hours to years. It can come from either a sample or an entire population.
   b. Make sure data collector(s) have both the time and knowledge they need to collect accurate information.
   c. College the data over a sufficient period to be sure the data represents “typical” results during a “typical” cycle.
   d. Sometimes there may be important differences within a population that should be reflected by sampling each different subgroup individually. Example: Collect complaint data from business travelers separately from other types of travelers.

3. Design a check sheet form that is clear, complete, and easy to use.

4. Collect the data consistently and accurately. *(Team members can help data collectors by showing support for the project. Above all—act on the data as quickly as possible!)*
### Example - Employee Satisfaction with Planning and Quality

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
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<tbody>
<tr>
<td>This institution involves its employees in planning for the future.</td>
<td>3.52</td>
<td>4.44</td>
<td>0.92</td>
<td>3.17</td>
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<tr>
<td>Efforts to improve quality are paying off in this institution.</td>
<td>4.07</td>
<td>4.49</td>
<td>0.42</td>
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<tr>
<td>There is a spirit of teamwork and cooperation in this organization.</td>
<td>3.50</td>
<td>4.45</td>
<td>0.95</td>
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</table>

Source: Campus Quality Survey: 1 to 5 scale

### Example: Women’s Sports Offered by Dakota Athletic Conference and Great Plains Athletic Conference

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<tr>
<th>Schools</th>
<th>Conference</th>
<th>Division</th>
<th>BB</th>
<th>XC/Track</th>
<th>Golf</th>
<th>Soccer</th>
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</table>
**DATA POINTS:** (Turning data into information)

Data can be in the form of words or numbers. Attribute data can be counted and plotted as discrete events. It includes the count of the numbers or percentages of good or bad, right or wrong, pass or fail, yes or no. (i.e., number of correct answers on a test, number of mistakes per typed page) Variable data can be measured and plotted on a continuous scale. (i.e., length, time, weight)

Collecting data – If you need to know the performance of an entire population (i.e., the DSU student body), the more economical and less time-consuming method is to draw a sample from the population. With a sample, you can make inferences about, or predict, the performance of a population. Basic sampling methods include:

- Random. Each and every observation or data measure has an equally likely chance of being selected. Use a random number table or random number generator to select the samples.
- Sequential. Every nth sample is selected.
- Stratified. A sample is taken from stratified data groups.

Categorizing data – When you stratify data, you break it down into meaningful subcategories or classifications, and from this point you can focus your problem-solving.

Example – Data often comes from many sources but is treated as if coming from one. Data on reported injuries for a university physical plant may be recorded as a single figure, but that number is actually the sum total of injuries by 1) type (cuts, burns, sprains), 2) location (eyes, hands, feet) and 3) building (gymnasium, student center).

What patterns are important to your data – Predictable patterns or distributions can be described with statistics.

- Measures of location
  - Mean (or average). Represented by $\bar{X}$, the mean is the sum of the values of the sample divided by the total number of the sampled data. Example: For the sample (3, 5, 4, 7, 5)

$$\text{Mean} = \frac{3 + 5 + 4 + 7 + 5}{5} = 4.8$$

  - Median. When sampled data are rank ordered, lowest to highest, the median is the middle number. Example: For the sample (3, 5, 4, 7, 5)
Median of $(3, 4, 5, 5, 7) = 5$

(When there are an even number of values, the median is the average of the middle two values.) Example: For the sample $(2, 5, 7, 4, 5, 3)$

Median of $(2, 3, 4, 5, 5, 7) = 4.5$

- **Mode.** The most frequently occurring value(s) in a sample. Example: For the sample $(3, 5, 4, 7, 5)$
  
  Mode = 5

- **Measures of variation**
  - **Range.** Represented by $R$, the range is the difference between the highest data value and the lowest data value. Example: For the sample $(3, 5, 4, 7, 5)$
    
    $R = 7 – 3 = 4$

  - **Standard Deviation.** Represented by $s$, the standard deviation of a sample measures the variation of the data around the mean. The less variation there is of the data values about the mean, the closer $s$ will be to zero. Example: For the sample $(3, 5, 4, 7, 5)$
    
    \[
    s = \sqrt{\frac{(3 - 4.8)^2 + (5 - 4.8)^2 + (4 - 4.8)^2 + (7 - 4.8)^2 + (5 - 4.8)^2}{5 - 1}}
    \]
    
    \[
    = \sqrt{\frac{3.24 + .04 + .64 + 4.84 + .04}{4}}
    \]
    
    \[
    = \sqrt{\frac{8.8}{4}}
    \]
    
    \[
    = \sqrt{2.2}
    \]
    
    \[
    = 1.48
    \]
Appendix D: Bibliography
Appendix E: Downloadable Forms

- PIED Checklist
- PIED Worksheet
- Sample agenda format
- Sample minutes format
PIED Checklist

<table>
<thead>
<tr>
<th>Steps</th>
<th>Person Responsible</th>
<th>Timeline / Tool</th>
<th>Date Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before you begin, download a new PIED worksheet.</td>
<td></td>
<td></td>
<td></td>
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</table>

1. **Plan Step**
   - Identify and complete the Tool(s) used to **Plan**

2. **Implement Step**
   - Identify and complete the Tool(s) used to **Implement**

3. **Evaluate Step**
   - Identify and complete the Tool(s) used to **Evaluate**

4. **Decide Step**
   - Identify and complete the Tool(s) used to **Decide**

**Plan**: Typical Tools--Brainstorming, Affinity Diagram, Check Sheet, Fishbone, Flowchart, Gantt Chart, Check Sheet, Data Points

**Implement**: Typical Tools--Flow Chart, Gantt Chart, Check Sheet, Data Points, other project management methods.

**Evaluate**: Typical Tools--Check Sheet, Flow Chart, Data Points

**Decide**: Typical Tools--Affinity Diagram, Brainstorming, Fishbone, Flow Chart
PIED WORKSHEET

<table>
<thead>
<tr>
<th>College/Functional Unit:</th>
<th>Champion(s):</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Strategic Focus:</th>
<th>Tool(s):</th>
</tr>
</thead>
</table>

| Team Members: | |
|---------------||

Based on the answers to questions in Step 1, set a broad goal, timeframe, target and evaluation measure below.

<table>
<thead>
<tr>
<th>Problem/Process: Brief description of the issue (e.g. 30% pass rate)</th>
<th>Goal and Timeframe</th>
<th>What is the current status/challenge?</th>
<th>Baseline and Target: What does a realistic improvement look like (e.g. 55% pass rates)</th>
<th>Evaluation Measure: What measures will be used to determine if outcome met?</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

The following section should be completed for each project or activity.

<table>
<thead>
<tr>
<th>Plan Project /Activity / Implementation strategy</th>
<th>Person(s) Responsible</th>
<th>Planned target and end date</th>
<th>Implement: Actual start date and end date</th>
<th>Data and Data Collection plan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

| Stakeholders: | |
|---------------||

| Resources: | |
|------------||

Communication of the problem and plan:

<table>
<thead>
<tr>
<th>Evaluate: Activity</th>
<th>Summary of data collected</th>
<th>Did you meet your target?</th>
<th>Is the solution having the intended effect? Are the measures valid?</th>
<th>Any unintended consequences?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Decision (institutionalize, restart PIED, or discontinue):

| Communication of the decision: | |
|-------------------------------||

Note: If an activity or project is institutionalized, it needs to be added to procedures / office calendar.
## SAMPLE AGENDA FORMAT

**DAKOTA STATE UNIVERSITY**

### Agenda

<table>
<thead>
<tr>
<th>Agenda</th>
<th>Who?</th>
<th>Desired Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meeting Date:</td>
<td>Chair:</td>
<td></td>
</tr>
<tr>
<td>Meeting Time:</td>
<td>Location:</td>
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<td>Membership:</td>
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<table>
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<th>Agenda Item</th>
<th>Who?</th>
<th>Desired Outcomes</th>
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<tr>
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<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
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</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Plus / delta</td>
<td>All</td>
<td>Identify strengths / weaknesses; reflect on what went well and did not work well.</td>
</tr>
</tbody>
</table>

**ISSUE BIN (from last meeting):**
## Sample Minutes Format

### Dakota State University

**Meeting of ABC Committee**

<table>
<thead>
<tr>
<th>Agenda Item</th>
<th>Follow-up Action</th>
<th>Who Responsible?</th>
<th>Deadline</th>
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<td></td>
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**Discussion:**

2. Xxxxx

**Discussion:**

3. Xxxxx

**Discussion:**

4. Xxxxx
Discussion:

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<th>Issues to be brought forward (Issue Bin):</th>
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</table>

<table>
<thead>
<tr>
<th>Review of Meeting (Plus/Delta):</th>
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<tbody>
<tr>
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<tr>
<td>Cons</td>
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