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The probability of continuous improvement given systematic inquiry

Building the Institutional Research Infrastructure for Scientific Research in Higher Education

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President

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Freshman (CIRP)	NSSE	Residential Life (EBI)	Etc., Etc.	Graduate Outcomes	SLO Assessment	General Education
Student Surveys						Program Mastery
Additional CDS Variables						Capstone Project
IPEDS Data Sets						SLO Assessment
Human Resources	Completions	IPEDS Data Sets	Additional State Variables	Database Transactions	Absences / Grades	
12-Month Enrollments	Fall Enrollment			External e-Resources	Facilities	
Admissions	First-Time Cohorts			National Student Clearinghouse		
						Employment (Public Institutions)

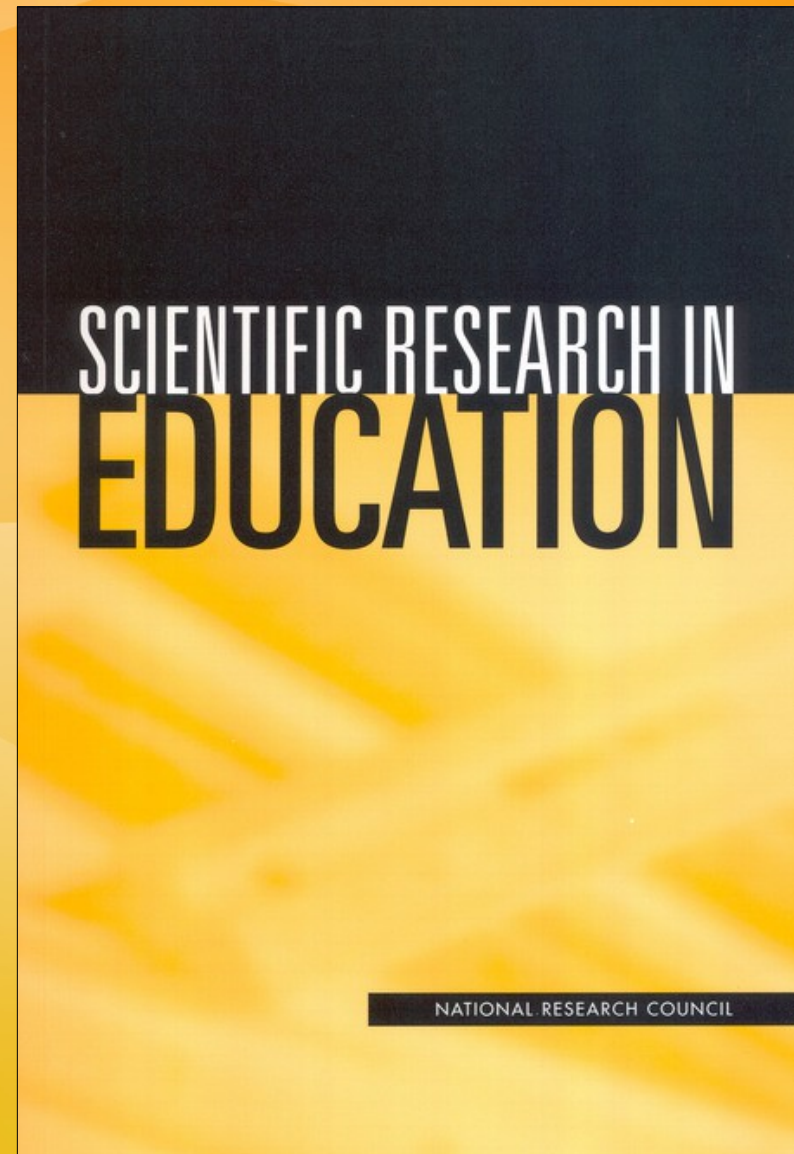
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National Research Council (NRC)

Scientific Research in Education (2002)

Does the NRC's report on scientific research in education apply to institutional research and effectiveness?



Institutional Research and Science: The Links

- “**Scientific research**, whether in education, physics, anthropology, molecular biology, or economics, is a **continuous process** of rigorous reasoning supported by **a dynamic interplay among methods, theories, and findings.**” – National Research Council [NRC], U.S. National Academies, *Scientific Research in Education* (2002).
- “**Institutional research** is defined broadly as the **methodical study** of any problem connected with the operation of the instructional programs of a college or university, together with an attempt to **implement a solution** to each problem or otherwise **effectively utilize the results** of such research. This concept includes not only traditional data gathering, processing, and interpretation and the study of operational procedures, but also it includes those activities usually called ‘**educational research**,’ a term whose many acceptable definitions all pre-suppose **disciplined, scholarly inquiry** into the processes of teaching and learning.” – Philip H Tyrrell (1962)
- **Historical Research** supports the development of **institutional research infrastructure** to align inquiry, planning, and interventions with the advances of **scientific research in higher education.**

Six Threats

The State of American Higher Education for the Near Future

1. Data-driven decision-making efforts in higher education have failed to yield the results that proponents suggest are easily within reach when data are more readily available.
2. Total expenditures by institutions of higher education have been growing ~66 times faster than the total revenue gained from improvements in student retention rates and progress-to-degree.
3. Total net revenue has stagnated as tuition increases are no longer reliable at a time when American household incomes remain flat and competitive advantages of tuition discounting diminished.
4. Federal statistics show high school graduate population peaked in 2009-10 and will not reach similar levels until 2022-23 when non-traditional students become ~50% of the college-going population.
5. To succeed, colleges and universities need to enroll and retain a growing a number of traditionally underrepresented populations in higher education: minorities, first generation, and low income students.
6. Governmental regulations and public expectations for effectiveness continue to drive colleges and universities to demonstrate continuous improvement for students, underrepresented populations in particular.

Scientific Research in Higher Education (National Research Council, 2002)

- “**Scientific research in education** can shed light on the increasingly complex and performance-driven U.S. education system.”
- “The scientific enterprise depends on a healthy community of researchers and is guided by a set fundamental principles... [S]ix **guiding principles underlie** all scientific inquiry, including education research:
 1. Pose Significant Questions That Can Be Investigated Empirically
 2. Link Research to Relevant Theory
 3. Use Methods That Permit Direct Investigation of Question
 4. Provide a Coherent and Explicit Chain of Reasoning
 5. Replicate and Generalize Across Studies
 6. Disclose Research to Encourage Scrutiny and Critique”

The Role for Institutional Research in the Study of Higher Education

- National Research Council:
 - “Like other applied fields, **education research** serves two related **purposes**: to add to fundamental **understanding of education-related phenomena** and events, and **to inform practical decision making**” (83).
 - “It is the scientific **community** that enables scientific progress, not... adherence to any one scientific **method**” (19).
- **Historia|Research**’s application of NRC principles to institutional research (from the **h|r** brief, “**Institutional Research’s Metropolis**”):
 - Institutions share responsibility for the study of higher education via the central administration of institutional research functions.
 - Administrative institutional researchers are scholars who must take the lead to form a healthy scientific community dedicated to the six guiding principles of the NRC.
 - Research activities must be organized into coordinated measurements and collaborative scientific investigations on higher education settings that fulfill the priorities of executive policy-advocacy and decision-making while also contributing to the accumulation of knowledge about higher education.

Scientific Research in Higher Education (National Research Council, 2002)

- Five design principles for institutional effectiveness and planning offices “to nurture scientific culture” and “promote... a vibrant education research enterprise:”
 1. Staff Departments with People Skilled in Science, Leadership, and Management
 2. Create **Structures** to Guide the Research Agenda, Inform Funding Decisions, and Monitor Work
 3. Insulate the Departments from Inappropriate Political Interference
 4. Develop a Focused and Balanced **Portfolio** of Research That Addresses Issues of Importance to Policy and Practice
 5. Adequately Fund the Department
 6. Invest in Research **Infrastructure**
- **Structures, Portfolio, and Infrastructure** for scientific inquiry must come from standards of institutional research as a social science.

Six Challenges

IR Infrastructure for Scientific Research in Higher Education

1. Scholars of higher education as a field of study do not recognize institutional research as a natural extension or integral site for the study of higher education.
2. No proper institutional research apparatus designed specifically for the advancement of research on higher education has been conceived or considered by scholars.
3. Institutional researchers find themselves overburdened by the requests of external agencies and the demands of internal clients with no research acumen.
4. Institutions largely organize strategic initiatives and institutional effectiveness studies through “virtual offices” of institutional research under the direction of ad-hoc committees.
5. National Association of System Heads considers institutional research as a profession ill-suited to meet the needs of the future for higher education.
6. Colleges and universities in the United States spend an estimated \$1 million per year per institution on the hidden costs of IR with little evidence of return on investment.

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The Core Institutional Research Infrastructure

Is there a scientific paradigm for institutional research to advance inquiry, planning, and effectiveness in higher education?



Very Large Array, National Radio Astronomy Observatory

Institutional Research and Technology: The Scientific Method

- “Attempts to increase the accuracy and scope with which facts... are known occupy a significant fraction of the literature of experimental and observational science. Again and again **complex special apparatus has been designed** for such purposes, and the invention, construction, and deployment of that apparatus have demanded first-rate talent, much time, and considerable financial backing.” – Thomas Kuhn, *Structure of Scientific Revolutions* (1962)
- “Tension may be expected between those who see data processing from the viewpoint of its machine processing and those concerned with **the art of research design**. Processors usually want extreme uniformity in classification and established categories... whereas researchers **insist on flexibility**. This is asked for primarily because the gathering of information **in a dynamic institution** will always be complicated by the diversity of the students, the faculty, and inherent institutional procedures traditionally emplaced from college to college.” Edward M. Stout and Irma Halfter, “Institutional Research and Automation” (1962)
- “Recognition should be given to the fact that the **information systems** of all levels of [higher] education **must be capable of being intermeshed**, and that these systems should fit **into the totality of the scientific community...**” R. J. Henle, *Systems for Measuring... the Resources and Activities of Colleges and Universities* (1967)
- **Historia|Research** coordinates and develops an apparatus to enable dynamic institutions to design research to enlarge scientific research in higher education.

Six Strengths

IR Infrastructure for Scientific Research in Higher Education

1. The typical portfolio of institutional research trace their origins to the application of social scientific principles to the study of higher education settings in the first IR offices of the 20th century.
2. Institutional researchers in the 1960s defined parameters for standards and technologies that support scientific inquiry into higher education settings.
3. Desktop computing power and the flexibility of social scientific software place scientific research within reach of all institutions regardless of type, size, and revenue.
4. National reporting requirements (IPEDS, etc.) provide standards and definitions for the measurement of resources and activities at colleges that provide a basis for a core institutional research infrastructure.
5. Institutional research literature has grown into an archive during the past fifty years that can be used for the basis of scientific collaboration and community for institutional researchers.
6. Institutional budgets and federal government grants annually allocate the funds sufficient to build an infrastructure that advances data-driven decision-making and generalizable knowledge for higher education.

Requisite Flexibility for an Institutional Research Apparatus

1. The “**Golden Triangle**” of Institutional Research Projects (Volkswain, 2011)
 - a. Reporting
 - b. Planning
 - c. Effectiveness
2. Spectrum of **Scientific Research Questions** (NRC, 2002)
 - a. Descriptive and Correlates
 - b. Systemic and Causal
 - c. Mechanism and Process
3. Results Support **Generalizations** (NRC, 2002)
 1. Links to Relevant Theory
 2. Reproducible and Replicable Studies
 3. Open to Professional Scrutiny and Critique
4. Responsive to the Higher Education **Research Community** (Henle, 1967)
 1. Simple Information Units
 2. Adequate Body of Information
 3. Single Unified System
 4. Comprehensive Compatibility
 5. Feasibility

Particular-General Gap

Requisite Function of an Institutional Research Apparatus

	Reporting	Planning	Effectiveness
Generalizations (Multi-Institution)	Standards and Definitions for Measurement of Activities at Colleges and Universities	Guidelines and Methodologies for Strategic Planning, Analysis, and Decision-Making	Research Agenda to Structure Inquiry and to Promote the Accumulation of Knowledge over Time
Institutional Research Apparatus	Common comprehensive data system for all institutions of whatever size, type, or complexity to lay a foundation for compatibility in a simplified and inexpensive form (Henle, 1967)		
Particularities (Single Institution)	Student Information System		Enterprise Resource Planning
	Student Surveys	Assessment Data	Personnel Records
			Advancement

* From the [Historia|Research](#) brief, "Search for a Paradigm, Part II"

Social Science Research Solution for a Common Comprehensive

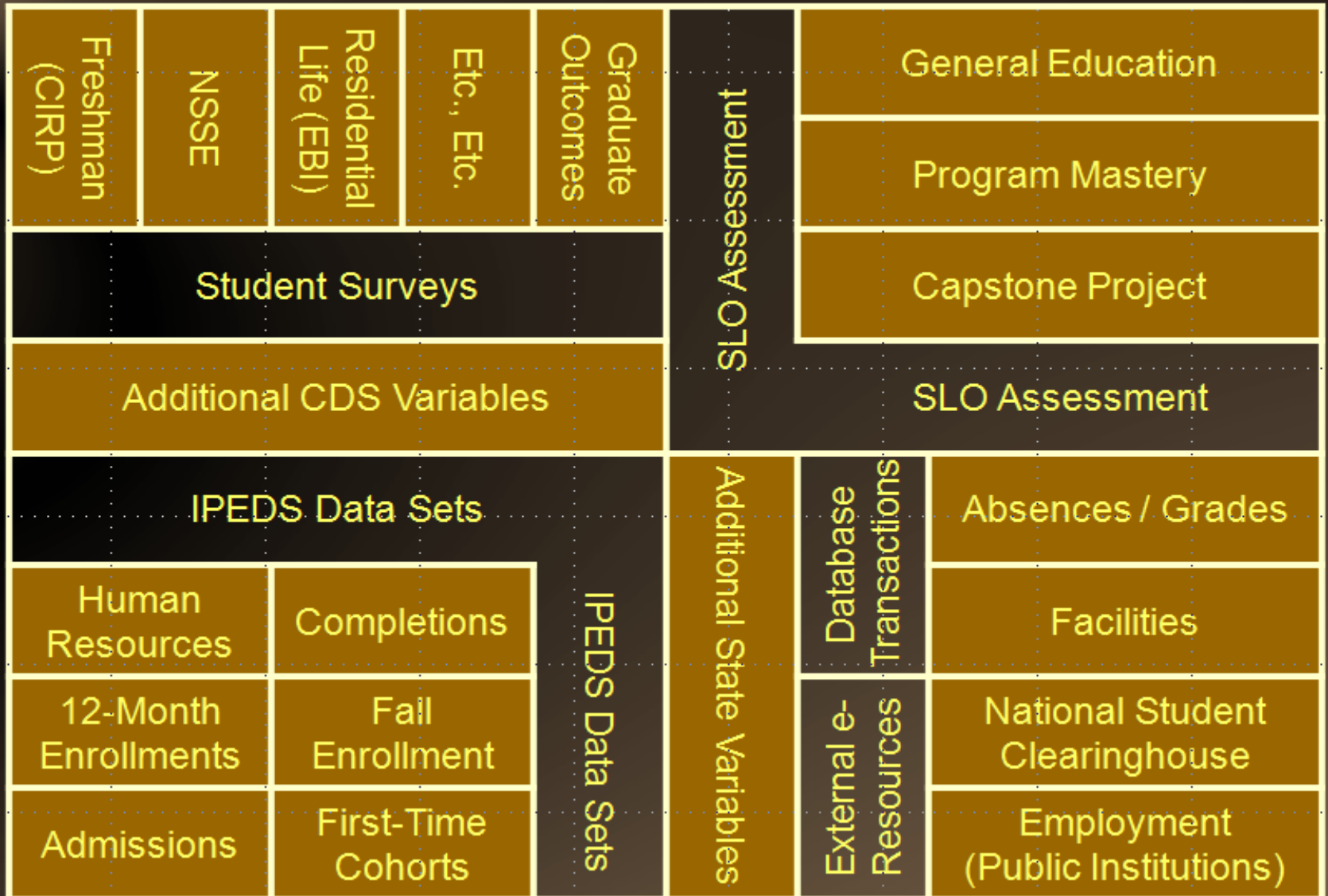
The hlr Apparatus

	Reporting		Planning		Effectiveness	
Analytics and Research Process	Automation for External Reports (IPEDS, etc.) and Fast Fact / Fact Book Preparations		KPI Dashboards, Predictive Analytics, Academic / Administrative Program Reviews		Exploratory Research, Assessment, and Quasi-Experimental Projects	
Data Set Compile Process (e.g., IPEDS)	Admissions		Fall Enrollments	Completions		Finance
	First-Time Cohorts	Financial Aid	Outcomes (Ret. / Grad.)	12-Month Enrollment	Human Resources	
IS / Database Calibration Process	Applications	Applicants	Plans	Degrees	Faculty Status	Jobs
	Addresses	Enrollments	Course Catalog	Classes	Job Codes	General Ledger
	External Institutions	Test Scores	Census Date File	Student Groups	Persons	Etc., Etc.

* From the [Historia|Research](#) brief, "Search for a Paradigm, Part II"

IPEDES Data Sets As the Core of an Apparatus in a Modular System

The h|r Infrastructure



* Partial representation of data sets in a comprehensive IR solution.

Comprehensive Research Apparatus for Effectiveness and Planning Projects

1. Discrete IPEDS data sets combine with each other to facilitate common and multiple institutional research projects.
 1. **12-Month Enrollment** data set merged to **Finance and Human Resource** data sets yields a rich resource of **Academic Program Review**.
 2. **Admissions, Fall Enrollment,** and **Financial Aid** data sets combine to facilitate **Enrollment Modeling**.
2. Refine planning and effectiveness efforts with increased number of data subsets and enlarged number of variables.
 1. Prepare and merge a non-IPEDS **Absence** data set with **Fall Enrollment** to refine understanding of retention indicators.
 2. Prepare and merge a non-IPEDS **Facilities** data set to **12-Month Enrollment** data set for **Space Utilization** study.
3. Conduct comparative analyses and collaborative studies with other institutional researchers utilizing the same core infrastructure.
 1. **Syntax** written specifically for the core **IPEDS-derived data sets** are **compatible at all institutions** without modification using same approach.
 2. **Effectiveness of interventions** at one particular institution may be **compared to other institutions** as non-random **control groups**.

Nine Modalities of IEP

NRC, Spectrum of Scientific Research Questions (2002)

Comprehensive Portfolio of Applied Research (with Historical Precedents)

Volkswain's "Golden Triangle" of Institutional Research (2011)

		1. Reporting	2. Planning	3. Effectiveness
		Data Integrity and Submission Compliance	Operations and Resource Analysis	Mission and Outcomes Research
1. Descriptive / Correlates	1.1 Statistical and Qualitative Reports	2.1 Correlations and Projections	3.1 Exploratory and Policy Research	
	<ul style="list-style-type: none"> FTE Staff and SCH per FTE Staff (1938) Faculty and Student Loads (1938) Student Demographics (1938) Classroom Space Utilization (1938) 	<ul style="list-style-type: none"> Academic Program Unit Costs (1938) Academic Program Cost Deviations and Budget Allocations (1938) Curriculum Development Correlation to Number of Enrollments (1938) 	<ul style="list-style-type: none"> Education Policy Research (1938) Correlation between Learning Outcomes and Pace of Curriculum Development (1954) Gender Equity in Education (1962) 	
2. Systemic / Causal	1.2 Survey and Ethnographic Research	2.2 Benchmarking and Competitive Analysis	3.2 Outcomes and Intervention Assessments	
	<ul style="list-style-type: none"> Student Evaluations (1954) Follow-up Surveys with Graduates (1954) Faculty Satisfaction Surveys (1962) Applicant Choice of College (1954) 	<ul style="list-style-type: none"> Academic Program Benchmarking (1938) Enrollment Trend Projections (1954) Faculty Salary Benchmarking (1962) 	<ul style="list-style-type: none"> Pre- and Post-Test Learning Outcomes in General Education (1954) Inter-rater Reliability and Validity of Grading Practices (1954) Change in Attitudes toward Psychiatry Associated with Program Intervention (1954) 	
3. Mechanism / Process	1.3 Electronic Automations and Machine Forecasts	2.3 Predictive Modeling and SEM	3.3 (Quasi-)Experimental Research	
	<ul style="list-style-type: none"> Enrollment Forecasts with Variable Parameters (1954) Predicting Academic Success (1954) Automation of Research Processes (1962) 	<ul style="list-style-type: none"> Effect of Relaxing General Requirements on Course-Taking Behaviors with Non-Randomized Control Group (1954) Predicting Medical School Success to Better Target Admissions (1962) 	<ul style="list-style-type: none"> Pre- and Post Test Learning Outcomes in Independent Studies Courses with Control Group (1962) Predicted vs. Actual First-Year GPAs to Identify Grade Inequities by Dept. (1962) 	

* Institutional research matrix from the [Historia|Research](#) brief, "Wealth of Institutions, Part II"

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The U.S. National Research Council's Challenge to Higher Education:

Do executives and institutional
researchers know how to
measure *the institutional
effectiveness* – the brightness
– of a college or university?



h|r Solution: Benefits to Partner Institutions

1. **Research Solution -- Not Another Technology Solution**
 - a. **Standard social science technology** is the only requirement
 - i. Desktop computing
 - ii. Statistical Package for the Social Sciences (SPSS)
 - b. **Low impact on IT resources**
 - i. No expensive data warehouse technology required
 - ii. IT support largely limited to established database / ERP responsibilities
 - iii. Research data secured by standard IT protocols
2. **Inclusive Decision Support Framework Based on Local Research**
 - a. A complete **portfolio of institutional research** possible locally
 - i. The “golden triangle” of institutional research (Volkswain, 2011)
 - ii. Full spectrum of scientific research questions (NRC, 2002)
 - b. Modular design offers **high degree of responsiveness**
 - i. Address urgent lines of inquiry by adding variables to core data sets
 - ii. Units and departments serviced with subsets of core data sets
3. **Replicable Research Capacity** from Others Using Same Apparatus
 - a. Readily **utilize tested research methods** developed at other institutions

h|r Approach: Benefits to Chief Institutional Effectiveness Officers

1. **Leverage Responsibility for Reporting** While Reducing the Burden
 - a. Establish federal / state specifications as institutional **general standards**
 - i. Build core data sets from the variable definitions and units of analysis
 - ii. Automate annual reporting from the core data sets to the extent possible
 - b. Utilize core data sets for **fact books, dashboards** and **scorecards**
 - i. Align institutional publications to institutional research professional standards
2. **Unify Appropriate** Institutional Planning and Effectiveness **Studies**
 - a. **Deploy core data sets** as strategic resource for planning and assessment
 - i. IEP leadership role in the “art of research design”
 - b. **Use advanced statistical methods** to refine findings and conclusions
 - i. Integrate business intelligence / predictive analytics with IR functions
 - ii. Perform analysis with standards of social scientific inquiry
3. **Collaborate** to Advance Scientific **Research in Higher Education**
 - a. General standards and core data sets **explicitly linked to theory**
 - i. Institutional research immediate source of scholarship in higher education
 - b. Professional and career development through **direct empirical research**
 - i. Methodology and analysis replicable by peers for collaboration and scrutiny

h|r Mission: Benefits to Chief Executive and Academic Officers

1. Institutional Research Functions Organized According to Professional Standards of a Social Science
 - a. Secure the integrity of data reported externally and utilized internally
 - i. Improve accountability and decision-making of direct reports to executives
 - b. Apply best-fit practices – as opposed to “best practices” – to address evidence-based challenges to the institution and its mission
 - a. Collaborative inter-institutional research to study student success at the record level and identify unique institutional opportunities/threats
2. Return on Investment from Institutional Effectiveness & Planning Office
 - a. Centralized Institutional Reporting Functions Yield Direct Cost Savings
 - a. Eliminate waste from non-specialist personnel and vendor expenditures
 - b. Set Measurable Outcomes for Planned Interventions or Implementations
 - i. Additional revenue estimated from student progress initiatives (retention, etc.)
 - ii. Standardized unit cost efficiencies set targets for expenditure reductions
 - iii. Institutional effectiveness studies funded by grants from external agencies
3. Extend competitive advantages of the institution through continuous improvements in service to the mission of the college
 - a. Build portfolio of strategic initiatives and effective innovations to extend knowledge of exemplary higher education administration

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