A how-to guide for education developers who
want to increase the impact of their work

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Improving undergraduate STEM education has been a national priority for several decades

"Improving undergraduate teaching is integral to meeting the pressing national need for more STEM majors." (AAU, 2011, p. 2)

REPORT TO THE PRESIDENT
ENGAGE TO EXCEL: PRODUCING ONE MILLION ADDITIONAL COLLEGE GRADUATES WITH DEGREES IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS

Executive Office of the President

President's Council of Advisors on Science and Technology

FEBRUARY 2012
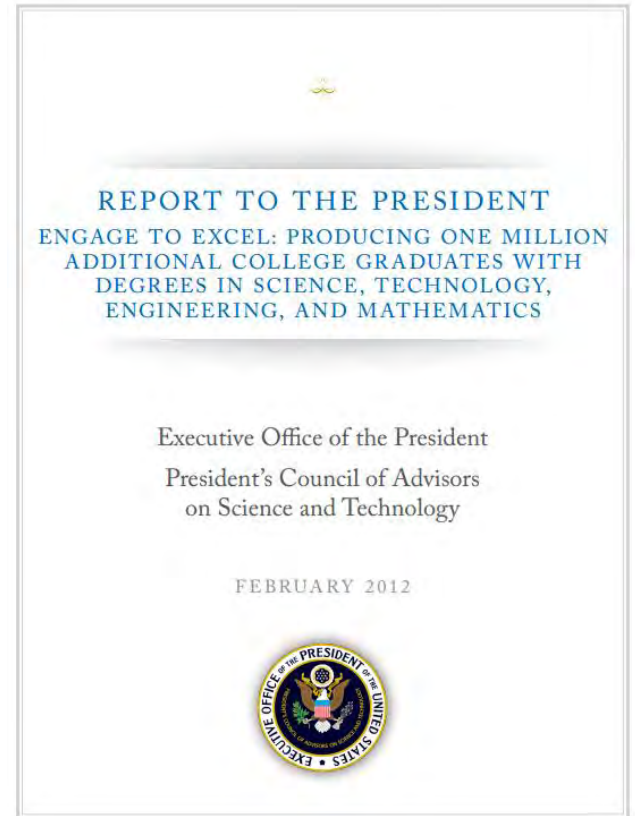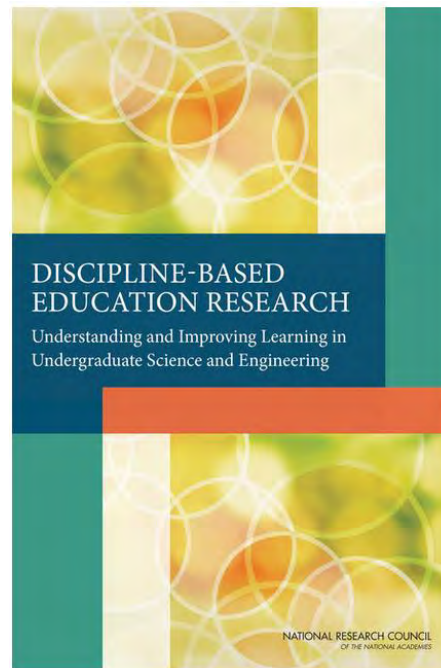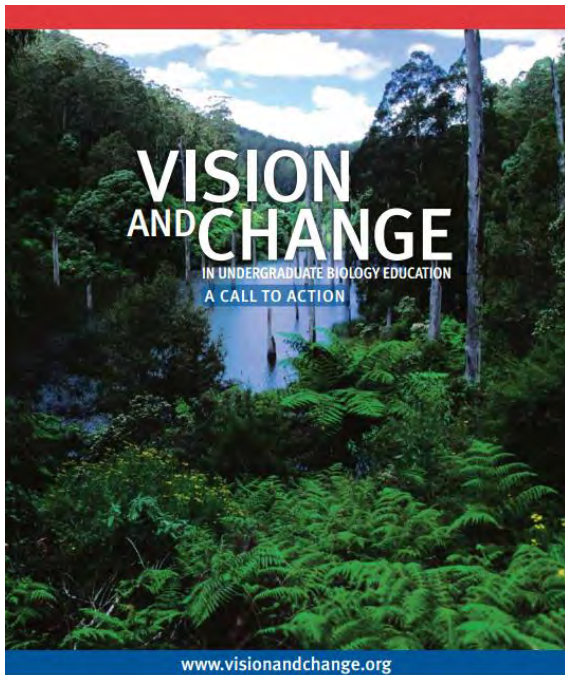
Many funding agencies have historically thought conceived of improving education in terms of development and dissemination of "best practices"
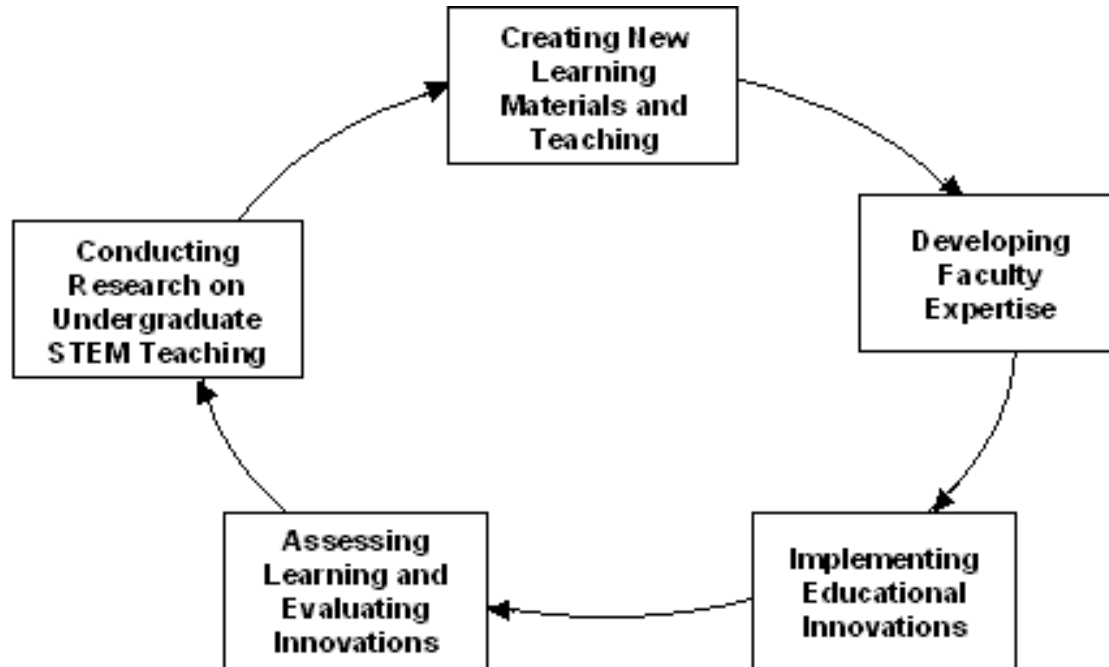
Cyclic model for knowledge production and improvement of practice in undergraduate STEM education

There is a need to change practice

Typical Practice

(Solitary) Development → (Passive) Dissemination

Successful Practice

Individual
Department
Institution
Extra-Institution
Initial System

Interactive Development → Interactive Dissemination → Support

Individual
Department
Institution
Extra-Institution
Desired System

- Identify potential adopters
- Consider the instructional system
- Address propagation from the beginning of the project

Increase the Impact

The funding landscape for undergraduate STEM education development is shifting

Funding agencies now require more focus on propagation. Development alone is not sufficient.

- The National Science Foundation – e.g., IUSE Solicitation – "**transferability and propagation are critical aspects** for IUSE-supported efforts and should be addressed throughout a project's lifetime..."[1]
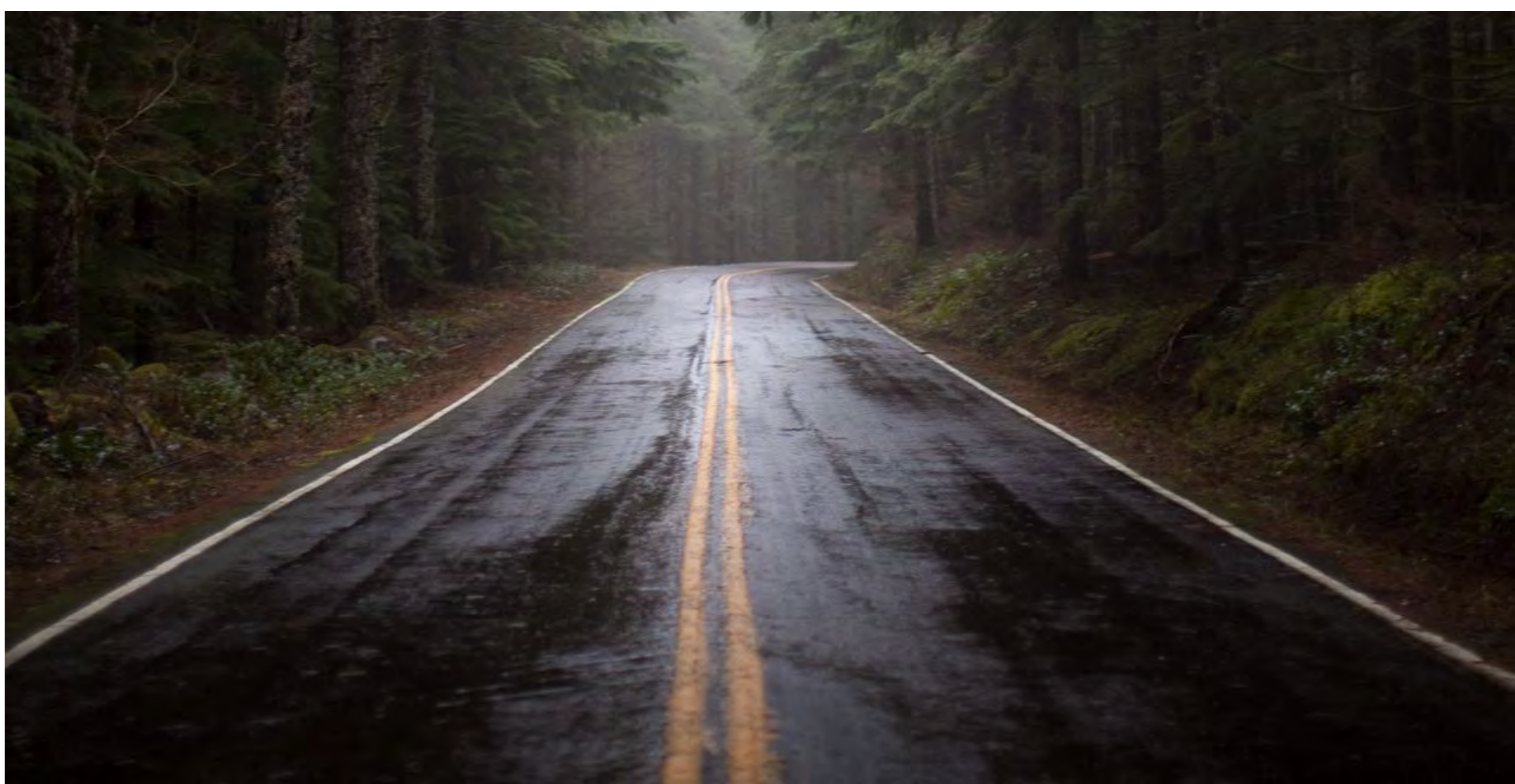
- The Howard Hughes Medical Institute – e.g., Science Education Grants – "For maximum impact…courses must be designed and implemented not just for a single section or school, but **for hundreds of thousands of students at colleges nationwide**."[2]

- **Alfred P. Sloan Foundation** – e.g., STEM Higher Education – "Successful proposals are expected to be…**concerned with the dissemination and portability of results to other institutions**."[3]

- **The Leona M. and Harry B. Helmsley Charitable Trust** – "We work closely with the organizations we support to craft grants that align with our strategies, set measurable goals, **offer scalable solutions to big challenges** and, most importantly, drive towards real and meaningful impact in improving lives."[4]

1. http://www.nsf.gov/pubs/2014/nsf14588/nsf14588.htm; 2. http://www.hhmi.org/advance-science/building-authentic-research-experiences;
3. http://www.sloan.org/major-program-areas/stem-higher-education/the-science-of-learning-stem/; 4. http://helmsleytrust.org/our-grants (emphasis added in all)

Typical dissemination practice does not work in most cases

Solitary Development	Passive Dissemination
STEP 1: Researchers develop innovation at one institution with little outside feedback or involvement[1]	STEP 2: Researchers publish a paper, give talk at a conference, maybe do a short workshop[1,2]

Education developers expect that other faculty will adopt based on the mass-market methods[1,2] and we know that is not realistic[3,4]

[1]Khatri, Henderson, Cole & Froyd 2013, [2]Tront, McMartin et al. 2012
[3]Rogers (2003), [4]Henderson, Cole, Froyd, & Khatri 2012

Increase the Impact

Typical dissemination practice makes one or more of four common mistakes

- Think that telling potential users about their innovation will be sufficient to promote sustained adoption

- Ignore the literature on change and adoption of innovations

- Focus only on product development, and not on potential adopters

- Wait to work on adoption until near the end of the project

Our research has analyzed typical practice, successful practice, and literature on change

Adopt & Drop ↖

Sustained Adoption ↓ ↓

No Adoption ↗ EXIT ONLY EXIT

- **Analysis of typical practice**
  - 75 NSF CCLI grant proposals funded in 2009

- **Analysis of successful practice: Case studies of well-propagated innovations**
  - PhET, PLTL, Peer Instruction

- **Synthesis of the related literature**
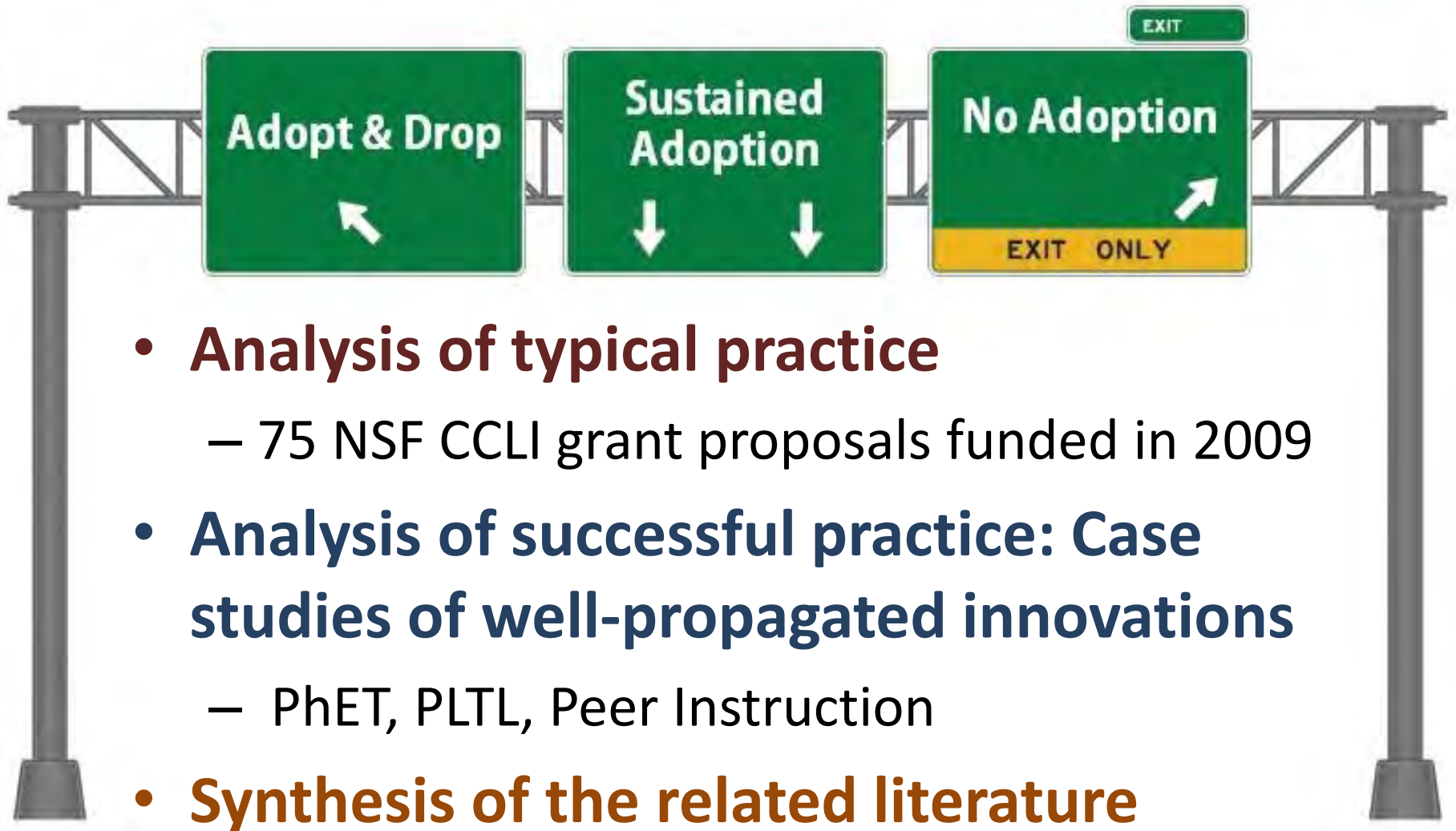
An effective propagation plan can be characterized by six elements

Potential adopters are identified	Extensive plan for attracting, training, & supporting adopters	Addresses propagation from the very beginning
Relevant instructional system elements identified	Plan clearly articulated, including rationale & strategies	Alignment between innovation, potential adopters, & the selected strategies

For more details, see: http://www.increasetheimpact.com/resources

Propagation plans can be evaluated with the Designing for Sustained Adoption Assessment Instrument

Category	Description
1. Project Type (descriptive)	(1) Specific curriculum and/or pedagogy (2) Professional resources focused on changing teaching practices
2. Features of Target Curricula and/or Pedagogies (descriptive)	(A) Features of the target curricula and/or pedagogies (B) Degree of change required for adoption/adaptation.
3. Propagation Activities (descriptive)	Identifies specific propagation activities
4. Characteristics of propagation plans associated with likelihood of success (evaluative)	Evaluate characteristics associated with successful propagation

http://goo.gl/hwSYBf

Exercise: Applying the Designing for Sustained Adoption Assessment Instrument

- Count off by 2.
- Individually review a 3-page structured summary of a proposal
- Individually evaluate the proposal using the distributed portion of the assessment instrument
- Pair 1's with 2's and talk about the differences

Three-page Structured Summary
(each part limited a ½ page)

- Present project overview, including project goals

- Identify potential adopters with rationale

- Describe development process

- Describe plan for broader impact, i.e., propagation plan

- Describe evaluation plan

- Describe project timeline

- Describe project personnel

Groups Working

Evaluation of summary: 15 min

Comparison of summary evaluations: 5 min
- How did ratings on the two versions of same proposal differ?
- What stood out as strengths in each proposal?
- What types of evidence did you use to make decisions about your ratings?

The Designing for Sustained Adoption Framework

Part 1. Understand the Gap

- Chapter 1. Understand Your Product
- Chapter 2. Identify Potential Adopters
- Chapter 3. Understand Instructional System(s)

Part 2. Bridge the Gap

- Chapter 4. Develop Interactively
- Chapter 5. Disseminate Interactively
- Chapter 6. Support Adopters

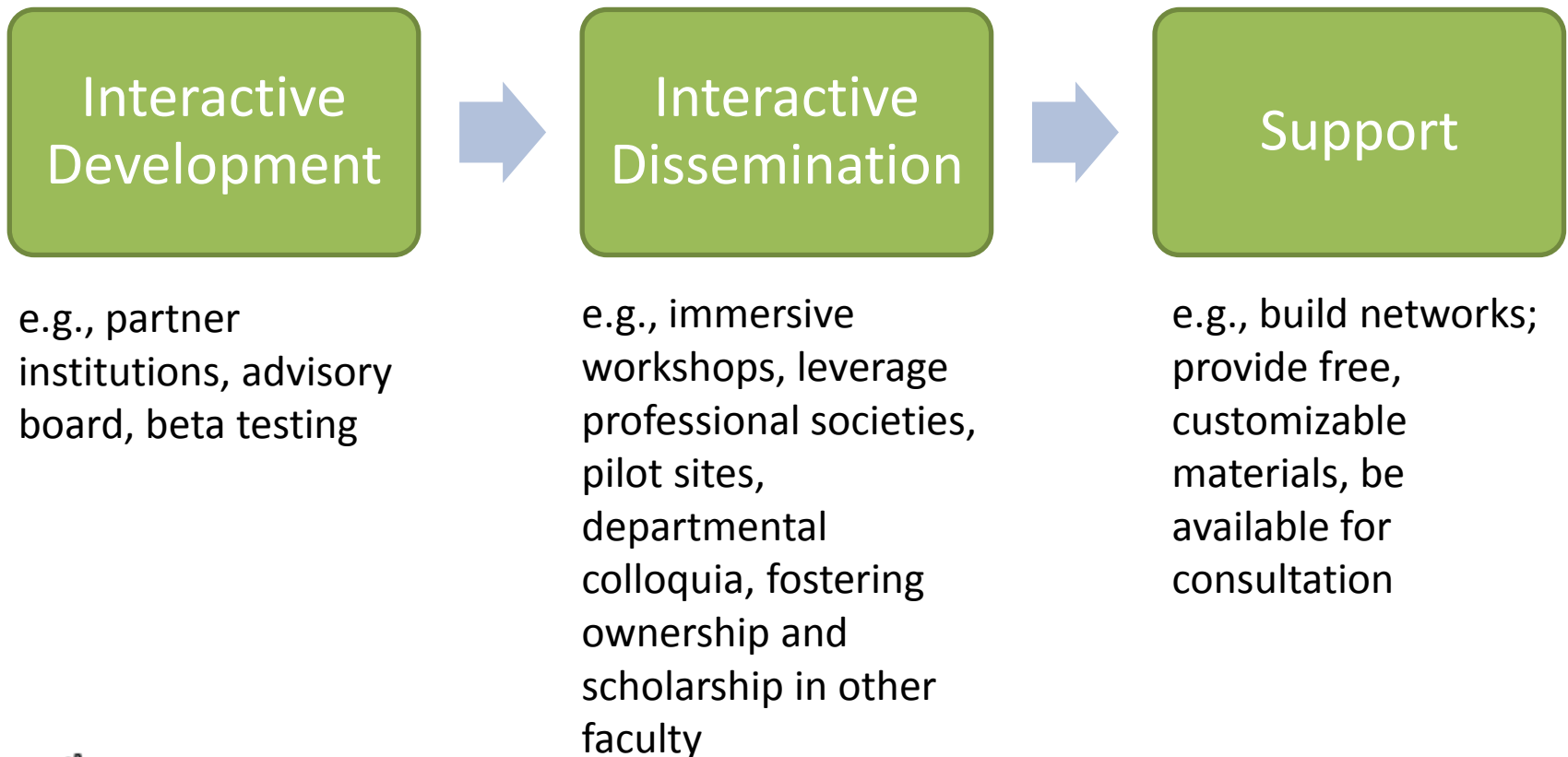## Part 3: Be Consistent

- Chapter 7. Check Your Alignment

Workshop experience using the framework resulted in improvements

Aspects of Propagation	Initial	Final
Intended Audience	3.5	4
Engage Users	4	4.5
From Beginning	3.5	4.5
Instructional System	2	4
Thoroughness	3.5	4.5
Strategies depend on type	3.5	4

Successful propagators identify potential adopters, interact with them, and support them

Interactive Development → **Interactive Dissemination** → **Support**

e.g., partner institutions, advisory board, beta testing

e.g., immersive workshops, leverage professional societies, pilot sites, departmental colloquia, fostering ownership and scholarship in other faculty

e.g., build networks; provide free, customizable materials, be available for consultation

Development	
Collect student learning and attitudes data in courses taught by:	Developer(s)
	Non-developer instructors in similar educational environments (e.g. institution type, class size, discipline)
	Non-developer instructors in a variety of types of educational environments
	Non-developer instructors with characteristics similar to the developer (e.g. demographics, beliefs, experience)
	Non-developer instructors with characteristics different from the developer
Collect instructor use data in courses taught by:	Developer(s)
	Non-developer instructors in similar educational environments (e.g. institution type, class size, discipline)
	Non-developer instructors in a variety of types of educational environments
	Non-developer instructors with characteristics similar to the developer. (e.g. demographics, beliefs, experience)
	Non-developer instructors with characteristics different from the developer

Dissemination		
Dissemination through:	Existing website e.g. NSDL, MERLOT	Social networking
	Listserv, email lists, etc.	Conference booth
	Promotional materials	Textbooks
	Project website	Introductory workshop (less than or equal to 3 hours)
	Journal publication	Extended, interactive workshop (more than 4 hours)
	White paper (technical reports)	Advisory board connections
	Conference presentation (talks or posters)	Mentoring of graduate students/post-docs
	Seminars/colloquiums	Personal connections with other instructors

Support	
Support Adoption by developing:	Instructional strategies and/or materials that can be easily modified by users (e.g., as a Word doc).
	Instructor guides, implementation guides, or FAQs
	Guidelines/advice for implementation in different environments
	Materials that can be adopted without taking a lot of instructor time.
	Materials in modular fashion that can be adopted piecemeal.
	Materials that are similar to what instructor already do
Support Adoption by:	Engaging other instructors in development or review of instructional strategies and/or materials
	Creating mechanisms to follow up with potential adopters (workshop attendees, people who download material)
	Leveraging existing instructor development communities (e.g., POGIL, PLTL, SERC, professional societies)
	Individual Consultations

Summary

- Undergraduate education development grants need a strong propagation plan.

- The Designing for Sustained Adoption Framework and tools can be used to help shape strong proposals.

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QUESTIONS?