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**MODULE DEVELOPERS' MANUAL**  
***STARTING POINT – ECONOMICS PEDAGOGIC PORTAL***

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## **A. BRIEF OVERVIEW OF THE *STARTING POINT-ECONOMICS* PROJECT**

This National Science Foundation (NSF) project (DUE 0817382) makes innovative pedagogical resources and effective teaching practices easily accessible to economists via a web-based pedagogic portal. *Starting Point-Economics* is being developed in collaboration with the Science Education Resource Center (SERC) at Carleton College (MN) and builds on their successful *Pedagogic Services* framework. At the core of this framework is a content management system that makes information on innovative pedagogical practices available on the web via a library of pedagogic modules. Components of these modules can be shared across multiple projects. The *Starting Point-Economics* project will both modify and add to the *Pedagogic Services* library of pedagogic modules.<sup>1</sup>

The goals of the *Starting Point-Economics* project are to:

- introduce economists to teaching innovations both within and beyond the discipline.
- provide instructors with the tools to begin integrating and assessing these innovations in their own classrooms.
- encourage the sharing of teaching innovations.

The goals of the project will be met by: (1) building an extensive set of teaching resources (pedagogic modules) for economics instructors, and (2) developing a community of instructors with a common interest in sharing effective pedagogical practices and contributing to a communal knowledge base.

### **(1) Building a set of Teaching Resources**

The pedagogic modules are the core of the *Starting Point-Economics* project. When complete, the *Starting Point-Economics* site will include sixteen (16) pedagogic modules, each focusing on a different teaching method. Seven (7) of the modules build on modules previously developed and shared by SERC and will be cross-referenced with these existing modules so that economists can learn from examples in other disciplines. The remaining nine (9) modules are new to SERC and will become part of the SERC pedagogic database (to be shared with other disciplines). Each pedagogic module will contain a general description of a single pedagogic method, a summary of research demonstrating the benefits to student learning, classroom implementation guides, and a library of economics-based examples that illustrate the teaching method in action. Each module, and the *Starting Point-Economics* site as a whole, can be linked to other pedagogical web sites subject to the fair use guidelines described at SERC [See Section J: A Word on Copyright].

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<sup>1</sup> See <http://serc.carleton.edu/sp/index.html>.

The sixteen *Starting Point-Economics* pedagogic modules will be released according to the following schedule:

- Fall 2009 – Context-Rich Problems, **Just-in-Time Teaching**, **Quantitative Writing**, **Teaching with Cases**, and **Cooperative Learning**
- Spring 2010 – Classroom Experiments, Teaching with Computer Simulations, Effective use of Personal Response Systems, Guided Inquiry, and Student Research
- Fall 2010 – Interdisciplinary Approaches to Teaching, **Service Learning**, **Spreadsheets Across the Curriculum**, Documented Problem Solving, Using Media to Enhance Teaching and Learning, and **Interactive Lectures**

*Note: **Bold** = modules previously developed by SERC*

## (2) Developing a Communal Knowledge Base

Once established, we hope that the *Starting Point-Economics* portal will help to build a community of economic educators who are connected to one another and with other scholars within and beyond the discipline. The wide scope of the modules and the ability to share examples and engage in an ongoing discussion related to innovations in teaching and learning will allow for participation by economic educators from a broad range of institutions, levels of experience, and theoretical perspectives. This community will have the potential to build a pedagogical knowledge base in a systematic and open manner so that insights gained by economics instructors implementing a specific pedagogy will not stand in isolation but instead can be linked to other work both within and outside of the discipline. We hope to create a teaching and learning commons that focuses on economic education but benefits from and helps to inform educational research across a broad spectrum of disciplines.<sup>2</sup>

## B. ROLE OF THE MODULE COORDINATORS

Module coordinators, experts in a particular teaching pedagogy, are responsible for developing and maintaining the pedagogic modules on the *Starting Point-Economics* web portal. Specifically, the role of the module coordinator is to:

- create the module content for a specific pedagogic practice (e.g. cooperative learning) [for new modules] or revise and update previously developed module content [for modules previously developed by SERC].
- build a library of ten (10) or more economics examples for each module illustrating the use of the highlighted pedagogy.
- participate in module development workshops at Carleton College (MN).

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<sup>2</sup> See, for example, Maier and Simkins (2008)  
 <[http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1151430](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1151430)> or  
<http://ideas.repec.org/p/pramprapa/9314.html>

- use SERC's content management system to post the module content, upload associated files and create links and a navigation structure.
- review submitted economics instruction examples for inclusion in the library of examples for each module.
- revise modules in response to reviewers comments.

### **(1) Creating/Revising Pedagogic Modules**

Module coordinators are responsible for overall pedagogic module development, including the development of a library of economics examples. They will develop the modules in conjunction with a series of two-day workshops to be held at Carleton College (MN). Workshop participants will be reimbursed for their travel related expenses. Module coordinators will develop a draft of module content prior to the workshop and use the face-to-face workshop time to review, critique, and modify module content with workshop participants (experts in the module topic, from economics and disciplines outside of economics) prior to posting on the *Starting Point-Economics* site.

### **(2) Building a Library of Economics Examples**

Each module includes a library of classroom-based economics examples (a minimum of ten (10) initially) illustrating the pedagogic practice highlighted by the module. These "teaching examples" pages are one of the most useful features of the *Starting Point-Economics* pedagogic portal. Teaching examples can include everything from a 5-minute in-class exercise to an extended student project. In general, the teaching examples provide ready-to-use economics-specific context for the pedagogic practice and serve as time-saving mechanisms for implementing new pedagogies in instructors' courses.

Module coordinators are responsible for developing and/or soliciting economics examples implementing the module's pedagogic practice. Workshop participants will be encouraged to develop examples and the project directors will actively solicit contributors via presentations at professional meetings, postings on web-based listservs and/or blogs, and personal contacts. However, the ultimate responsibility for populating the examples library resides with the module coordinators. Module coordinators should begin soliciting potential examples contributors and secure commitments from them no later than two months before the module is posted on the *Starting Point-Economics* site. The project director overseeing each module will request periodic updates from the module coordinators on activity submission progress and offer assistance as needed.

The *Starting Point-Economics* site will also include a mechanism for ***unsolicited contributions*** of examples from instructors who have implemented the highlighted pedagogic practice in their own courses. Module coordinators will review contributed examples prior to posting them on the *Starting Point-Economics* site.

Specific information about the structure and development of pedagogic modules is covered in the following sections of this Manual.

## C. MODULE ORGANIZATION

The goal of each pedagogic module is to provide the full range of information that a faculty member needs to successfully implement a specific teaching method. We will be using the structured format previously developed by SERC for development of the *Starting Point-Economics* modules. This structured format makes it easy for module coordinators to develop module content and for instructors to browse across multiple teaching methods. Each module includes both discipline-independent content (related to the general pedagogical practice) and discipline-specific examples illustrating how the pedagogical practice is used in economics.

Each pedagogic module includes the following six components, which appear as separate web pages on the *Starting Point-Economics* site: (1) module introduction, (2) description of the pedagogic practice, (3) effectiveness in promoting student learning, (4) how to implement the pedagogic practice, (5) economics teaching examples, and (6) references and resources. Each of these module components is described and illustrated below.<sup>3</sup> A visual representation of the entire *Starting Point-Economics* site is included in Appendix A.

**Developers' Note:** While the discussion that follows suggests a linear, hierarchical structure, note that most users of the *Starting Point-Economics* site will not enter at the top level of the module. Instructors are most likely to enter at the “how to implement” or “examples” pages and most likely will arrive there via a web search (e.g. Google). Keep this in mind as you develop your module content, both in terms of making the information self-contained and making it engaging so that users will want to continue reading further within the module.

### (1) Module Introduction

The module introduction page serves as a table of contents to the module. Users browse this page to decide if they want to look further. This page contains:

- a brief (1-3) sentence definition of the pedagogical practice, which may also include a relevant quote or image.
- links to the five remaining components (what is, why use, how to, examples, and references), along with a one-sentence summary of each of the components.

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<sup>3</sup> Please take time to view some of the existing SERC modules at: <http://serc.carleton.edu/sp/library/pedagogies.html>. We will use the *Cooperative Learning* pedagogic module to illustrate the module components in this section.

A screen shot of the introductory page of the Cooperative Learning module at SERC's *Pedagogy in Action* pedagogic portal is illustrated below. The *Starting Point-Economics* site will use the same type of web layout as illustrated in the *Pedagogy in Action* screen shots used here.

Note that the brief descriptions, or tag lines, bulleted above are key in that they provide enough interesting information about what is on the following pages that the user wants to see more. However, if these tag lines are too long the user is not inclined to read them and sees only the headings. Additionally, long tag lines increase the likelihood that valuable information contained in the lower sections of the page are not readily visible. The Cooperative Learning module introductory page provides an example of tag lines that hide key components of the introductory screen.



Source: <http://serc.carleton.edu/sp/library/cooperative/index.html>

## (2) Description of the Pedagogic Practice

This is designated as the “what is?” page. This page describes the teaching method and its distinguishing features. The description answers question such as:

- What are the central attributes of this method? This page is used by many who have heard of a method but aren't sure what it is.
- What differentiates this teaching method from others?
- What opportunities for assessment are associated with the method?
- What conditions are optimal for this teaching method? (Class size, learning environment, etc)
- What is the preferred learning environment?



- Are there any required resources or technology (or other traits of a logistical nature)?

As noted above, the key is to be comprehensive, yet concise, using links to additional pages on specific topics related to the pedagogic practice when necessary. The writing should quickly capture the interest of the reader and draw her/him into the pedagogic practice more deeply.

A screen shot of the “what is?” page of the Cooperative Learning module at SERC’s *Pedagogy in Action* pedagogic portal is illustrated below. Notice (along the left-hand-side menu in the screen shot) that each page on the *Starting Point-Economics* site can have one or more sub-pages associated with it (in this case, the site lists a sub-page on Types of Cooperative Learning Groups).

**Pedagogy in Action**  
the SERC portal for Educators

Search the Site

Pedagogy in Action > Library > Cooperative Learning > What is Cooperative Learning?

**What is Cooperative Learning?**

Cooperative learning involves more than students working together on a lab or field project. It requires teachers to *structure* cooperative interdependence among the students. These structures involve [five key elements](#) which can be [implemented](#) in a variety of ways. There are also [different types of cooperative groups](#) appropriate for different situations.

**More than Just Working in Groups**

Five key elements differentiate cooperative learning from simply putting students into groups to learn ([Johnson et al., 1998](#)).

- 1. Positive Interdependence:** You'll know when you've succeeded in structuring positive interdependence when students perceive that they "sink or swim together." This can be achieved through mutual goals, division of labor, dividing materials, roles, and by making part of each student's grade dependent on the performance of the rest of the group. Group members must believe that each person's efforts benefit not only him- or herself, but all group members as well.
- 2. Face-to-Face (Promotive) Interaction:** Important cognitive activities and interpersonal dynamics only occur when students promote each other's learning. This includes oral explanations of how to solve problems, discussing the nature of the concepts being learned, and connecting present learning with past knowledge. It is through face-to-face, promotive interaction that members become personally committed to each other as well as to their mutual goals.
- 3. Individual Accountability:** The essence of individual accountability in cooperative learning is "students learn together, but perform alone." This ensures that no one can "hitch-hike" on the work of others. A lesson's goals must be clear enough that students are able to measure whether (a) the group is successful in achieving them, and (b) individual members are successful in achieving them as well.
- 4. Interpersonal and Small Group Social Skills:** In cooperative learning groups, students learn academic subject matter (taskwork) and also interpersonal and small group skills (teamwork). Thus, a group must know how to provide effective leadership, decision-making, trustbuilding, communication, and conflict management. Given the complexity of these skills, teachers can encourage much higher performance by [teaching cooperative skill components](#) within cooperative lessons. As students develop these skills, later group projects will probably run more smoothly and efficiently than early ones.

[Types of Cooperative Learning Groups](#)

[Why Use Cooperative Learning?](#)

[How to Use Cooperative Learning](#)

[References and Resources](#)

[Web Resources](#)

[Examples](#)

[Earth History Approach](#)

[Experience-Based Environmental Projects](#)

[Field Labs](#)

[Gallery Walks](#)

[Games](#)

[Indoor Labs](#)

[Interactive Lectures](#)

[Investigative Case Based Learning](#)

[Just in Time Teaching](#)

Source: <http://serc.carleton.edu/sp/library/cooperative/whatis.html>

### (3) Effectiveness in Promoting Student Learning

This is designated the “why use?” page. This page describes when and why the method is particularly effective, with references to educational (general and economics-specific) and learning sciences research. This page provides answers to questions such as:

- What are the potential learning outcomes promoted by this teaching method?
- What learning sciences areas (e.g. misconceptions, expert-novice learning, transfer of learning, metacognition) does this teaching method address?
- What is the potential for assessment of learning outcomes?



- What does current research (generally or discipline-based) have to say about this teaching method?
- What is the evidence (qualitative and/or quantitative) that this method works? Under what circumstances does it enhance student learning? Why does it enhance learning? A critical role of this page is to bridge between faculty interest in teaching and educational research that provides insight into teaching.

A particularly important component in this section is the assessment of learning outcomes. Please provide as much guidance for instructors as possible on how others have assessed student learning using this teaching method and suggest new assessment processes (both formative and summative) that instructors might consider. Some useful resources include:

Field-tested Learning Assessment Guide (FLAG)

<http://www.flaguide.org/>

Angelo, T. A. & Cross, K. P. (1993) *Classroom assessment techniques: A handbook for college teachers (2<sup>nd</sup> edition)*. San Francisco: Jossey-Bass.

A screen shot of the “why use?” page of the Cooperative Learning module at SERC’s *Pedagogy in Action* pedagogic portal is illustrated below.

**Pedagogy in Action**  
the SERC portal for Educators

Search the Site

Pedagogy in Action > Library > Cooperative Learning > Why Use Cooperative Learning?

**Why Use Cooperative Learning?**

**Academic Achievement**

Will cooperative learning help students learn geology? Students who work in cooperative groups do better on tests, especially with regard to reasoning and critical thinking skills than those that do not (Johnson and Johnson, 1989 ).

According to a review of 168 studies of individual achievement in college classes, cooperative learning is half again as effective as either competitive learning or individual learning (Johnson et al., 1998 ). According to many studies, it does result in higher grades and better scores on tests of volume and accuracy of information learned, long-term retention of that information, problem-solving and higher reasoning abilities.

After teaching organic chemistry for ten years using noninteractive lectures, Paulson (1999) switched to active learning and cooperative learning techniques. He found that the average number of students passing the three-quarter organic chemistry sequence doubled (from 38% to 75%).

[Click here for chart with data](#)

In Slavin, 1991 's review of 67 studies, 61% of the cooperative-learning classes achieved significantly higher test scores than the traditional classes. He notes that the difference between the more and less effective cooperative-learning classes was that the effective ones stressed group goals and individual accountability.

Students learning science cooperatively are more likely to use scientific thinking to follow problems than those who work alone, or those working from a step-by-step lab book (Lord, 2001 ).

Source: <http://serc.carleton.edu/sp/library/cooperative/whyuse.html>

#### **(4) How to Implement the Pedagogic Practice**

This is designated as the “how to” page. This page, the most popular destination for instructors, describes how to use the method effectively and includes tips for the instructor. This section works together with the specific examples to enable the instructor to use the method effectively. Instructions, framing, and tips that apply to all examples are best summarized at this level in the module while instructions and tips that are specific to an example should appear on the example page. A good test of the module is to read an example and the module together and consider whether or not you could successfully implement the example.

A critical role for this section is to assist the first time user. Module users have commented on the importance of this section in providing enough guidance to generate confidence to try the method, clear instruction on where/how to start with the method, and a framework for thinking about the full implementation.

This section is generally very prescriptive and includes things such as:

- step-by-step instructions
- formative assessment activities to assess student learning
- list of challenges
- tips for first time use
- classroom management
- suggestions for types of content best suited for this method

It is critical however, that these things be arranged in a way that provides a framework for implementation and is not perceived as a laundry list.

A screen shot of the “how to” page of the Cooperative Learning module at SERC’s *Pedagogy in Action* pedagogic portal is illustrated below.

**Pedagogy in Action**  
the SERC portal for Educators

Search the Site

Pedagogy in Action > Library > Cooperative Learning > How to Use Cooperative Learning

**Pedagogy in Action**

- Library
- Assessment
- Calibrated Peer Review
- Campus-Based Learning
- Conceptual Models
- Cooperative Learning**
  - What is Cooperative Learning?
  - Why Use Cooperative Learning?
  - How to Use Cooperative Learning**
    - Pre-Instructional Planning
    - Explain the Assignment
    - Monitor and Intervene
    - Assessment
    - Group Processing
  - References and Resources
  - Web Resources
  - Examples
    - Earth History Approach
    - Experience-Based Environmental Projects
    - Field Labs
    - Gallery Walks
    - Games
    - Indoor Labs

## How to Use Cooperative Learning

No matter what the setting is, properly implementing cooperative learning involves five key steps.

### Pre-Instructional Planning

Prior planning helps to establish effective groups and projects. Plan out how groups will be formed and structure how the members will interact with each other. [Learn more here](#)

### Explain the Assignment to the Students

Students need to get their "marching orders." Explain the academic task to them and what the criteria are for success. Then structure the cooperative aspects of their work. Set up the positive interdependence and individual accountability and then specify what the expected behaviors look and sound like. [Learn more here](#)

### Monitor and Intervene

This is where you let the groups run while you circulate through the room to collect observation data, see whether they understand the assignment, give immediate feedback and praise for working together. If a group is having problems, you can intervene to help them get on the right track. [Learn more here](#)

### Assess

Some informal assessment is already done while you are monitoring the groups during the exercise. However, once the group finishes their project, work should be assessed by both instructor and group. [Learn more here](#)

### Process

Group processing involves asking the groups to rate their own performance and set goals for themselves to improve their cooperative work. [Learn more here](#)



Source: <http://serc.carleton.edu/sp/library/cooperative/howto.html>

### (5) Discipline-Based Teaching Examples (Activities)

This page contains links to a collection of examples (or activities) illustrating how the pedagogic practice can be used in economics courses. The examples, aimed at economics instructors, bridge the general module content with the actual day-to-day teaching experience of instructors. The examples make the module relevant and understandable while providing ideas for ways in which the instructor can use the method in his/her classes. Examples serve as a source of ideas and are also used either as presented or with minor modification by faculty. Each example should be fully implementable with the materials on the example page in association with the overarching material in the module. Each module must contain a minimum of ten (10) examples, although we expect this number to grow as *Starting Point-Economics* users submit new examples to be posted on the site.

Ideally, each teaching method should have examples that provide a range of ideas for using the method in economics. A template for developing examples/activities will be used to ensure uniformity and completeness of the material and to ensure that examples can be easily found through the use of common web search engines, as well as through the *Starting Point-Economics* site. A draft of this template is available at: [http://serc.carleton.edu/econ/submit\\_activiti.html](http://serc.carleton.edu/econ/submit_activiti.html). It will be reviewed and modified at the April 2009 workshop.

Module coordinators will be responsible for ensuring the quality of the posted examples.<sup>4</sup> The user should be able to decide at a glance if the example is of interest by reviewing the topic addressed and making an assessment as to the ease with which the method could be adapted for his/her own class.

**Developer's Note:** Many users will enter the *Starting Point-Economics* site by doing a web search for pedagogic examples that they can use in their own courses. Once at the *Starting Point* site they may simply browse through the examples that are available for a given pedagogic practice. The listing of the module activities on the browse page of the module includes the title and the first two lines of the short description of each example. Thus, it is critical to have a strong short description with no wasted words at the outset. The browse of activities is driven by the vocabularies and reflects accurate tagging by the authors and editors.<sup>5</sup> In assigning the vocabulary terms it is important to assign only terms where the relationship between the module and the term is obvious and important. Users should not arrive at a page based on choosing a term and wonder why they are there.

The remainder of the example page provides a structure for presenting information needed for the faculty member to use the activity. The use of this common structure makes the examples easily browsed while promoting completeness. The example format has been tested extensively with faculty who find each field to be important. Most commonly the assessment and tips sections are underdeveloped. The organization of examples in a module should be determined in consultation with the project directors.

Each example should contain all materials needed to execute it (e.g. handouts and worksheets, instructions, instructor notes). In addition, all the instruction the faculty member needs to effectively execute the example should either be provided or directly referenced. For instance, if the example includes a think-pair-share activity, the example should include instructions or a link to information on how to effectively do a think-pair-share. In other examples you may need to include information on how to lead a discussion. If the example requires knowing something special that is specific to the example to execute it with success, include it as part of the example pages (e.g. typical errors, things to look out for, ways to increase efficiency, and so on). This section is highly valued by users and is typically underdeveloped. It plays a critical role in building the user's confidence in their ability to successfully implement the example.

A screen shot of the "examples" page of the Cooperative Learning module at SERC's *Pedagogy in Action* pedagogic portal is illustrated below. Note that these examples generally focus on geoscience applications while the examples developed for the *Starting Point-Economics* site will focus on economics applications.

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<sup>4</sup> A description of required content for each example is covered in section E, while the criteria for evaluating example quality and completeness is covered in section F.

<sup>5</sup> Controlled vocabularies for use with module examples/activities are discussed in section G.

The screenshot shows the 'Pedagogy in Action' website, which is the SERC portal for Educators. The main navigation bar includes a search box and a 'Go' button. Below the navigation bar, the breadcrumb trail reads 'Pedagogy in Action > Library > Cooperative Learning > Examples'. The left sidebar contains a list of categories: Library, Assessment, Calibrated Peer Review, Campus-Based Learning, Conceptual Models, Cooperative Learning (highlighted), What is Cooperative Learning?, Why Use Cooperative Learning?, How to Use Cooperative Learning, References and Resources, Web Resources, and Examples (highlighted). The main content area is titled 'Examples' and shows a search bar with the text 'search'. Below the search bar, it indicates 'Results 1 - 10 of 13 matches'. The first three results are listed: '2004 Asian Earthquake and Tsunami Disaster Project', 'Teaching Mineral and Rock Identification with a Jigsaw Activity', and 'National Parks Jigsaw'. Each result includes a brief description and a subject line. A 'Narrow the View' dropdown menu is visible on the right side of the results area. The subject dropdown is open, showing a list of subjects with the number of matches for each: Chemistry (1 match), Environmental Science (1 match), Geography (1 match), Geoscience (5 matches), and Mathematics (7 matches).

Source: <http://serc.carleton.edu/sp/library/cooperative/example.html>

## (6) References and Resources

This page lists all references used in the module, including references to web-only material. For uniformity, we will be using APA format for all references.<sup>6</sup>

A screen shot of the “references and resources” page of the Cooperative Learning module at SERC’s *Pedagogy in Action* pedagogic portal is illustrated below. Each module in the *Pedagogy in Action* site also contains a separate “Web Resources” page that provides annotated summaries of web resources related to the highlighted pedagogical practice. A screen shot of the “web resources” page of the Cooperative Learning module at SERC’s *Pedagogy in Action* pedagogic portal is also illustrated below. In the *Starting Point-Economics* site this will be combined with the references and resources page. We believe it would be more useful to the user to have the reference page broken up into sections along the lines of important themes.

<sup>6</sup> Information on APA format is available at: <http://owl.english.purdue.edu/owl/resource/560/01/> and [http://www.library.cornell.edu/t/help/res\\_strategy/citing/apa.html](http://www.library.cornell.edu/t/help/res_strategy/citing/apa.html).





# Pedagogy in Action

the SERC portal for Educators

[Pedagogy in Action](#) > [Library](#) > [Cooperative Learning](#) > [References and Resources](#)

## References and Resources

- [Blosser, P. \(1992\)](#) . Using Cooperative Learning in Science Education. ERIC CSME Bulletin 92-1.  
This review discusses the definition of cooperative learning, applications for science classrooms, and research on its effectiveness.
- [Giraud, G. \(1997\)](#). Cooperative Learning and Statistics Instruction. Journal of Statistics Education, 5(3).  
This study examined the relative effects of cooperative vs. lecture methods of instruction.
- [Herreid, C. \(1998\)](#) . Why Isn't Cooperative Learning Used to Teach Science? Bioscience v58 no7 p553-559.  
This article summarizes reasons that science lecturers are reluctant to incorporate cooperative learning into their classes, research that supports its effectiveness, and advice to implement it.
- [Johnson, D.W. and R.T. Johnson \(1989\)](#) . Cooperation and Competition: Theory and Research. Edina, MN: Interaction Book Company  
This book summarizes over 750+ studies on the issues surrounding use of collaborative learning in the classroom.
- [Johnson, D.W., R.T. Johnson, and K.A. Smith \(1991\)](#) . Active learning: Cooperation in the college classroom. Edina, MN: Interaction Book Company  
This book contains lots of interesting material about the effects of having students work in groups, mostly in the form of increased motivation and performance in college classes.
- [D.W. Johnson, R.T. Johnson, and E. Johnson Holubec \(1998\)](#) . Cooperation in the Classroom. Edina, MN: Interaction Book Company.  
This handbook for cooperative learning deals with specifics on how to use it at the level of the classroom and the school.
- [D.W. Johnson, R.T. Johnson, K.A. Smith \(1998\)](#) . Cooperative Learning Returns to College: What Evidence Is There that it Works? Change July/August, p27-35  
This review of 168 studies of cooperative learning over 73 years concludes that cooperative learning is almost 150% as effective as individual or competitive learning in terms of academic achievement.
- [D.B. Kaufman, R.M. Felder, H.Fuller \(1999\)](#) . Peer Ratings in Cooperative Learning Teams. Annual American Society for Engineering Education Meeting Proceedings of the 1999 Annual ASCE Meeting, Session 1430.  
This article includes a peer-rating form used to assess participation on group projects by the participants. Self-ratings and test grades correlated with peer ratings.

- Pedagogy in Action
- Library
- Assessment
- Calibrated Peer Review
- Campus-Based Learning
- Conceptual Models
- Cooperative Learning**
  - What is Cooperative Learning?
  - Why Use Cooperative Learning?
  - How to Use Cooperative Learning
- References and Resources**
- Web Resources
  - Examples
  - Earth History Approach
  - Experience-Based Environmental Projects
  - Field Labs
  - Gallery Walks
  - Games
  - Indoor Labs
  - Interactive Lectures
  - Investigative Case Based Learning
  - Just in Time Teaching
  - Mathematical and Statistical Models

Source: <http://serc.carleton.edu/sp/library/cooperative/refs.html>



# Pedagogy in Action

the SERC portal for Educators

[Pedagogy in Action](#) > [Library](#) > [Cooperative Learning](#) > [Web Resources](#)

## Web Resources

- [The Cooperative Learning Center at the University of Minnesota](#) ([more info](#)) : Run by David and Roger Johnson, this site contains essays, information about their books and workshops, newsletters, and an FAQ on the theory and practice of cooperative learning, especially at the college level.
- [Teaching Concerns: Cooperative and Collaborative Learning](#) ([more info](#)) : This subsite is part of the Teaching Resource Center at the University of Virginia. It contains articles on cooperative learning from their newsletter.
- [The Cooperative Learning Network](#) ([more info](#)) : This site belongs to a group at Sheridan College in Ontario promoting cooperative learning, especially at the college level and contains links to essays and discussion forums.
- [Doing CL](#) ([more info](#)) : Substantial collection of resources including detailed instructions for various cooperative-learning techniques and an annotated bibliography. Brought to you by the National Institute for Science Education.
- [International Association for the Study of Cooperation in Education](#): IASCE supports those who are interested in the study of cooperation in education by providing a forum in which to share research and lessons about the practice of cooperative learning.
- [Active/Cooperative Learning: Best Practices in Engineering Education](#): This NSF-funded project at Arizona State University has interviewed over 20 faculty who offer suggestions for preparing students for teamwork, developing instructional materials, and implementing and assessing cooperative learning lessons and activities. The site also contains content-specific engineering projects.
- [University of Minnesota ResearchWorks: Cooperative Learning](#): This article from the ResearchWorks publication of the University of Minnesota profiles Drs. David and Roger Johnson who run the Cooperative Learning Center on Campus. The article also provides some basics of what cooperative learning is.
- [Changing a Course from Lecture Format to Cooperative Learning](#) ([more info](#)) : This essay describes the experience other instructors have had when switching a class (marine geology in this case) from a traditional lecture format to a cooperative-learning format: citing increased achievement, motivation, and attendance on the part of the students. However, the author also writes about the changes he experienced switching roles from lecturer to facilitator: both good and bad.

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Source: <http://serc.carleton.edu/sp/library/cooperative/webgroup.html>

### **A word about using SERC's catalog of references:**

SERC maintains a catalog of references, which supports cross indexing across the site. All references used in the *Starting Point: Economics* site will be added to the existing catalog. Module coordinators will be responsible for putting references in appropriate place, and adding a short (several sentence) description/abstract for each. SERC will use a cataloger to finalize the process of adding new references to the catalog. Module coordinators should search through the existing catalog to look for reference matches, especially the "Research on Learning" collection that includes both online and print references, available at:

[http://serc.carleton.edu/sp/search.html?q1=sercvocabs\\_72%3A3](http://serc.carleton.edu/sp/search.html?q1=sercvocabs_72%3A3).

If a match is found, the module coordinator can add it to the reference page using a [resource] tag, identifying the resource number, which is located in the URL of the resource link.

More on the use of references can be found at:

<http://serc.carleton.edu/serc/cms/dlib.html>.

### **D. DEVELOPING NEW MODULES AND REVISING EXISTING MODULES**

As indicated in Section B, each module coordinator is responsible for the development and maintenance of a specific pedagogic module, including a library of economics examples using the highlighted pedagogic practice. Coordinators will develop the modules prior to and during a series of topic-based face-to-face workshops to be held at Carleton College (MN). The project directors will inform module coordinators of the workshop dates for their respective modules. Coordinators will develop the basic modules prior to the workshops; workshop participants will revise and expand the modules' content.

**New Module Development.** Some module coordinators will be developing brand-new modules and will use the framework outlined in Section C to guide their development. A module development template will be provided to ensure uniformity and completeness in the structure of the *Starting Point-Economics* site across modules.

**Revision of Existing SERC Modules.** Other module coordinators will be revising and updating modules previously created for the *SERC Pedagogy in Action* site. In many cases these modules were developed with geoscientists in mind and contain references to the geosciences. Module coordinators will revise and update these modules to focus on economics instruction.

In either case, it is important to ensure that the core pages of all modules are discipline agnostic (or at least as disciplinarily broad as the pedagogy itself). Discipline-specific information should be isolated on pages which can be removed from the module without destroying its integrity. Modules can be cloned for use by



other disciplines, a process that will allow for navigation differences across clones. For example, it is possible for an economics version of a module to skip geosciences specific pages and vice versa. Thus, it is critical that disciplinary-specific information is relegated to stand-alone pages so the generic version can be made available as a base for other disciplines.

**Developers' Note:** The issue of how to incorporate discipline-based pedagogic knowledge into the modules is still under discussion (3/2009). Most likely this will lead to development of a "Using (pedagogy X) in Economics" page that will be added to the module structure illustrated in Appendix A. This will be discussed further at the April, 2009 workshop.

## **E. DEVELOPING A LIBRARY OF ECONOMICS TEACHING EXAMPLES**

In addition to developing or revising module content, all module coordinators are responsible for developing and maintaining a library of economics-related class-based teaching examples illustrating how to use the module's highlighted pedagogic practice. As part of the basic module development, module coordinators and SERC workshop participants will develop the initial set of teaching examples and will solicit other economists for additional examples. Over time we expect the teaching examples section to grow as instructors using *Starting Point-Economics* contribute their own examples for review and posting on the site. Module coordinators will act as editors for these contributed examples. Criteria for evaluating contributed examples are covered in section F of this Manual.

### **(1) Soliciting Teaching Examples**

The module coordinator and SERC workshop participants will provide the initial set of teaching examples for each module. Soon afterward, we expect this group to solicit teaching examples from several sources, including colleagues, those identified through the economics education literature as having done work with this pedagogy, users of the site, and participants at conferences where we present information about *Starting Point-Economics*. The module coordinator may ask others, including those who attended the workshop, to assist in recruiting economic educators to submit teaching examples. Full attribution for each teaching example will be given in the online resource, increasing the value of submitting examples to the *Starting Point* site.

### **(2) The Structure of Teaching Example Pages**

The "teaching examples" pages are one of the most useful features of the *Starting Point-Economics* pedagogic portal. Consequently, they require careful attention in their development. "Teaching examples" pages should:

- provide all of the information a faculty member needs to successfully implement an example, and
- enable instructors to quickly determine if they want to learn more about this example.

Each teaching example contains the following eight (8) components, which are consistent across examples and across modules:

- (a) a heading that contains the example title, author attribution and email address, a brief summary of example, and a related image that provides context with visual appeal
- (b) measurable goals for student learning
- (c) context for how this activity used, including the type of course and at what point in the course.
- (d) a description of the example and complete set of teaching materials needed to implement the example, such as handouts, data and instructions for students
- (e) teaching notes and tips for the instructor
- (f) assessment information that describes how the instructor can measure students' achievement of the specified learning goals
- (g) references and links to other print and online resources and information that support the specific example
- (h) a short description that will be displayed in web-based search engine results

An example of a "Teaching Example" page from the *Pedagogy in Action* site is illustrated below.

The screenshot shows the Pedagogy in Action website interface. The header includes the site name and a search bar. The breadcrumb trail reads: Pedagogy in Action > Library > Cooperative Learning > Examples > How well can hand size predict height?. The left sidebar contains a navigation menu with categories like Library, Assessment, and Cooperative Learning. The main content area features the title 'How well can hand size predict height?' followed by author information, a CAUSE logo, a summary, learning goals, and a context for use section.

**Pedagogy in Action**  
the SERC portal for Educators

Pedagogy in Action > Library > Cooperative Learning > Examples > How well can hand size predict height?

## How well can hand size predict height?

This page is authored by Carl Lee, Central Michigan University, which is one of the activities in the "Real-Time Online Hands-on Activities" at <http://stat.cst.cmich.edu/statact/> supported by the NSF/CCLI #0310932. The co-director of the project is Felix Famoye, Central Michigan University.

**CAUSE** This material was originally developed through CAUSE as part of its collaboration with the [SERC Pedagogic Service](#).

### Summary

This activity uses student's own data to introduce bivariate relationship using hand size to predict height. Students enter their data through a real-time online database. Data from different classes are stored and accumulated in the database. This real-time database approach speeds up the data gathering process and shifts the data entry and cleansing from instructor to engaging students in the process of data production.

### Learning Goals

This activity is designed to help students learn the issues related to data measurement and production, to learn the relationship of two variables. By the end of this activity, students will be able to

- explain the importance of data measurement and production in a given context,
- compare different measurements and distinguish which one has smaller variation when measured repeatedly,
- apply graphical and numerical techniques to describe and interpret the relationship between two variables in a given context,
- explain the least square method in a given context,
- distinguish between causation and association,
- determine if a linear model is appropriate or not using graphical residual analysis tools,
- identify outlying cases and determine the effect of the outlying cases.

### Context for Use

- This activity is appropriate for introducing bivariate relationship at introductory level with high school algebra as prerequisite.

Source: <http://serc.carleton.edu/sp/library/cooperative/examples/18172.htm>

### (3) Creating Teaching Examples

A common template – called an example sheet – incorporating the eight components listed above will be used to assist in the development of *Starting Point-Economics* teaching example pages. Think of the example sheets as a worksheet for developing the teaching examples that will ultimately be posted on the *Starting Point-Economics* site. Faculty will benefit from the standardized format of examples pages that allow them to efficiently skim a large number of examples to find those most relevant to their needs. The goal of the example sheets is to concisely communicate to other faculty what the key elements of the example are so that they can adapt the example for their own environment or perhaps use it as a source of inspiration and good ideas. The examples serve to illustrate in a concrete way how the particular teaching method highlighted in a given module might play out in the classroom.

Each example sheet should contain all materials necessary to conduct the example: student handouts, instructor notes and the like can be embedded in the page as downloadable files. In some cases the example sheet may draw heavily on materials available elsewhere, with links or bibliographic references provided as appropriate. In addition, an example sheet may describe an example that has been documented elsewhere – either on the web or in print. Remember that the example works with the overarching description of the pedagogic method. Material in the overarching module can be referenced (linked to) and need not be repeated.

A complete teaching example is included in Appendix B. The individual components of the example, outlined for module developers in an example sheet template, are described below.

A draft version of the teaching examples web submission template is currently available: <http://serc.carleton.edu/30114>. This form will be revised upon feedback from users at the first workshop in April 2009.

#### (a) Heading Material

This section of the example sheet includes the following components:

- **Teaching Method.** The Teaching Method is the pedagogic module appropriate for the example (e.g. Cooperative Learning).
- **Title.** The title should be evocative of the main point(s) of the example. It should communicate the full context of the example on its own as it will show up in places like search returns (e.g. Google) where people won't have any contextual clues. It should convey the idea that this is a teaching example and include both the subject matter and the pedagogical focus. An example of an effective title is: *Understanding the Multiplier Effect: A Think-Pair-Share Exercise*.

- **Author.** Name and institution of author(s) of the example and any other appropriate attribution information (e.g. departmental affiliation). If the page is based on materials originally created elsewhere, it should be noted with attribution given to the original authors and links provided to the original materials. SERC is in the process of developing a format scheme for handling author information. Information will be updated on that process as it becomes available. An example of an effective author component is: *This page authored by Jon Smith, Department of Economics, Big State University, based on an original example by Jane Smith, Smallville College.*
- **Email.** Email addresses of the example author(s) separated by commas. These will be displayed in the example page. These email addresses control the editing access. All email addresses listed will have authoring access in perpetuity. The email address must match exactly the email used in the SERC account.
- **Summary.** This text should make it clear what the example is. It should provide an overview of the things that students will do and the intended outcomes. The description should be concise and compelling. The summary must be able to be browsed at a glance – thus brevity is critical and the summary should not exceed 1 short paragraph.

### Example Sheet Summaries

**Example 1:** In this biology lab, students investigate whether goldenrod gall fly larvae collected from restored prairie area are different from larvae collected from a small native prairie 10 km away. They look for biochemical differences in proteins using cellulose acetate electrophoresis. Students determine the genotype of each gall fly; students compare the combined class' genotypes for the two groups of gall flies statistically using chi-square analysis. Students read a related scientific paper and discuss it in a subsequent lab session. Students write a full lab report describing their results using standard scientific paper formatting. A detailed description of this format and the writing process is provided.

**Example 2:** In this Spreadsheets Across the Curriculum activity, students are guided step-by-step to build a spreadsheet that compares the future value of an investment that grows exponentially (compound interest) to the future value of the same investment that grows linearly (simple interest). The students calculate the year-to-year succession of future values, plot them on XY-graphs against time, and fit trend lines. The module emphasizes the differences in the future values many years out from the initial investment. Spreadsheet difficulty level is elementary. This module can be the students' first experience in building a spreadsheet to perform a systematic calculation.

- **Related Image.** While not required, it is often useful to include a small (200 pixels wide or less) image illustrating the example or its use in class to provide visual interest and immediate context. This could be an image of the “output” of the example or a photo of people engaged in the example (or something similar). Note that images must be copyright-free. More information on copyright is presented in Section J.

### **(b) Measurable goals for student learning**

What concepts and content should students learn from this example? Are there higher-order thinking skills (e.g. critical thinking, data analysis, synthesis of ideas, model development) that are developed by this example? Are there other skills (writing, oral presentation, field techniques, equipment operation, etc.) that are developed by the example? For each of the learning goals you should be able to list associated assessment activities in the “assessment” component of the teaching example (see (f) below).

### **(c) Context for using in different teaching situations**

This text should help faculty understand the types of teaching situations for which this example is appropriate. Important types of context include grade/educational level, class size, institution type, etc. Is it a computer lab, lecture, or field exercise; is it a short or a longer-term project? How much time is needed for the example? Is there special equipment or software that is necessary? Are there skills or concepts that students should have already mastered before encountering this example? How is this example situated in the course? How easy (or hard) would it be to adapt the example for use in other settings or for different age groups (if possible)?

### **(d) Example description and teaching materials needed to implement the example**

This section should include a narrative describing the mechanics of the example and all the materials needed to implement the example (or links and references to those materials).

- Examples of student output are especially useful to include. Even a scanned image of data collected, graphs constructed, etc. will provide faculty with a guide to determine the effectiveness of the example in achieving desired outcomes.
- If the material is available on another site, provide the full web address.
- If you have the materials in electronic form, they can be uploaded and they will be embedded in the final page so that they can be downloaded by users.

- Provide a complete bibliographic reference for all published print materials that are included.
- If the example is fully documented at another site provide the web address along with a brief (one or two sentence) description of the other site.

For all materials include a brief description of each item describing what it is and what its role is in the example.

If you want to upload files as part of your example remember to consider their final use in deciding on appropriate formats. Materials that other faculty are likely to modify should be provided in easily editable formats (plain text, Word files or image files), while materials that are intended to be used without modification should be provided in PDF format.<sup>7</sup>

Image files should be compressed or scaled so that the file sizes are not too large. The maximum file size allowed is 20MB, but unless there is a compelling reason to do otherwise, all files should be much smaller than that.

#### **(e) Teaching notes and tips for instructor**

This section should include notes and tips for instructors who might use the example. Information such as common areas of confusion, things that need reinforcement, practical tips, and pointers for making the best use of the example are appropriate. Note that this section should complement, rather than repeat, the more general guidance about the teaching method provided in the methods module of which this example is a part. This is one of the most highly valued sections of the activity sheet. Provide as much detail as you can.

#### **(f) Assessment activities describing how the instructor will measure student achievement of learning goals**

This section should describe how the author determines whether or not students (either individually or collectively) are achieving the learning goals outlined for the example. Again, it is useful to include examples of student output and reference this in the discussion of determining if learning goals have been met. Other relevant assessment strategies may also be described in this section. Remember that the materials posted here are available via the open web and can be found by students.

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<sup>7</sup> See [http://en.wikipedia.org/wiki/Portable\\_Document\\_Format](http://en.wikipedia.org/wiki/Portable_Document_Format) for additional information and [http://en.wikipedia.org/wiki/List\\_of\\_PDF\\_software](http://en.wikipedia.org/wiki/List_of_PDF_software) for a list of PDF software.

**(g) Resources and references to other online information in support of this specific example**

This section should include references and links to online resources that discuss the specific example or that will support faculty and/or students using the example. Surveys of module use by SERC staff indicate that faculty often use these examples for material that is outside their specific specialty area, particularly for broader introductory or second year courses. References should thus provide faculty with enough points to find background information on the particular discipline-specific content so they are comfortable with its use. References related to the general teaching technique should not be included here, but should be recommended for inclusion in the associated module and links to this material in the references page may be helpful. If you have published a paper describing the activity and its impact, this is a good place to provide that information.

Web resources should include both the complete web address and a brief description of the site (and why it is relevant). Print resources should include basic citation information as well as a brief description of the resource.

**(h) Short description that is displayed in web-based search engine results**

The short description should be a distillation of the summary above. This description will be displayed in web-based search engine results. The optimal length for this description is 1-2 sentences. The first two lines appear in the browse return and thus are particularly important. Do not waste words in these descriptions.

**F. REVIEWING CRITERIA FOR SUBMITTED EXAMPLES**

As noted previously, the module coordinator's role includes the review of submitted teaching examples. These teaching examples may be generated through the personal solicitation of module coordinators or through the teaching example web submission form that will be included as part of the *Starting Point-Economics* site. Coordinators will carefully review the examples for completeness, accuracy, relevancy, and ease of use before posting them on the *Starting Point-Economics* site.

Module coordinators will employ certain criteria when reviewing the teaching examples and will work with authors to ensure that the materials meet these standards. The criteria are:

**(1) Does the material present important economics concepts or models?**

Remember that the *Starting Point-Economics* site is aimed at entry-level courses in economics.



- Is the content part of the core principles curriculum in economics?
- Is the content a prerequisite for more advanced material?

**(2) Is the material accurate?**

- Does the material present valid (correct) concepts, models, and results?
- Are there any factual, numerical, or conceptual errors?
- Are the references appropriate and complete?
- Are the material and the technique current?

**(3) Is the example likely to lead to the desired learning?** The teaching example should explicitly link the illustrated activity to specific learning outcomes or objectives.

- Does the material help develop conceptual understanding of economics or help uncover student misconceptions/preconceptions?
- Are the learning goals clearly stated?
- Is there good alignment between the stated learning goals and the likely learning outcomes of the example?
- Will the assessment strategies allow the instructor to determine if the learning outcomes have been met?

**(4) Does the pedagogy promote learning?** This question looks at whether the example incorporates effective teaching and learning strategies based on learning theory and learning sciences or other educational research. Some possible questions to address in this section:

- Does the example motivate and engage students?
- Does it build on what they know and address their initial beliefs?
- Is it appropriate for the variety of students expected in the class incorporating, if possible, opportunities for students to iterate and improve their understanding incrementally?
- Is there an appropriate balance of guidance (using immediate and positive feedback) vs exploration (allowing for reflection, discussion and synthesis)?

**(5) Are the materials provided complete and helpful?** This question addresses nuts and bolts issues about whether the materials provided are successful in providing the context, motivations and goals of the example and whether instructions and questions are clear.

- Could you quickly make a decision about whether you would like to look further at this example?
- Is there sufficient information about the prerequisite knowledge required by students?

- Are the supporting materials sufficient for you to use the example effectively? Are the materials provided for the student to use complete and clear?
- Are the teaching tips appropriate and sufficient?
- Is there enough detail provided for you to implement an assessment of the example?

**(6) Does the example correspond well with the associated teaching method?**

All of the examples in a given module should relate to the highlighted teaching practice.

- Is it clear how the material in the teaching module applies to the example?

All teaching examples are subject to final approval by the project directors before being submitted for inclusion on the *Starting Point Economics* Website.

## **G. CONTROLLED VOCABULARIES (FOR SEARCHING WITHIN THE SITE)**

Users will be able to search for examples in the *Starting Point-Economics* portal in three ways:

- a free text search over the contents of the activity sheets
- a faceted browse by pedagogic method (these are the same methods for which we are developing modules)
- a faceted browse by topic

For an example of what this looks like in practice see the following:

[http://serc.carleton.edu/introgeo/browse\\_examples.html](http://serc.carleton.edu/introgeo/browse_examples.html)

In order to support faceted browse by topic, we need to develop a set of no more than 12 terms that describes the breadth of our collection. A proposed set of terms will be presented and discussed at the first developers' workshop.

## **H. A WORD ON LEARNING THEORY AND RESEARCH-BASED TEACHING PRACTICES**

One of the distinguishing features of the *Starting Point-Economics* site is that the pedagogical practices included on the site are intentionally grounded, when possible, in discipline-based or general learning science research. Below are two frameworks for thinking about this issue.

### **(1) *How People Learn* Literature and Implications for Teaching**

*How People Learn: Brain, Mind, and Experience*<sup>8</sup>, published in 2000, provides a valuable summary of important research results from the learning sciences over the past

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<sup>8</sup> See Bransford, John D.; Brown, Ann L. and Cocking, Rodney R. (eds.). *How People Learn: Brain, Mind, Experience, and School*. National Academies Press, 2000  
[http://www.nap.edu/openbook.php?record\\_id=6160](http://www.nap.edu/openbook.php?record_id=6160) and Bransford, John D. and Donovan, M.

30 years and their implications for teaching and learning. As noted in the Executive Summary of *How People Learn*, “As a result of the accumulation of new kinds of information about human learning, views of how effective learning proceeds have shifted from the benefits of diligent drill and practice to focus on students’ understanding and application of knowledge.” (p. xi)

Module coordinators should keep the following learning issues in mind as they develop their pedagogic module. Whenever possible, module content should explicitly incorporate and reference these topics in their development of the module content and teaching examples.

- **Understanding Student Pre/Misconceptions.** Students don’t come into our classes as blank slates; their mental models affect what they learn. Often what they learn is different from what we’re teaching. Pedagogies and teaching examples that help to make visible student pre/misconceptions can significantly increase student learning.
- **Novice vs. Expert Performance and Learning.** Experts use structured mental models to order and categorize new information; novices tend to focus on surface properties and often fail to develop the structured mental models that characterize expert learning. One of the goals of the pedagogic modules and associated teaching examples is to promote more expert-like thinking in students.
- **Transfer of Learning.** For students to develop the ability to transfer knowledge to new situations they must be given the opportunity to apply new knowledge in a variety of situations and contexts. This takes time, guided learning, “desirable difficulties,” and feedback “about the degree to which they know when, where, and how to use the knowledge they are learning.” (*How People Learn*, p. 47) If possible, teaching examples should provide multiple opportunities for student practice of a particular concept or idea.
- **The Importance of Formative Assessment.** Assessment is critical to provide students with feedback on their learning; assessment should include both content knowledge and process knowledge (e.g. *how* students solve problems). Information about formative assessment should be included in both the module pages (“How to”) and the teaching examples.
- **Helping Students Become Reflective Learners (Metacognition).** Instruction should help students become self-directed learners; this requires directed practice that encourages student reflection about the learning process and how learning is being achieved. Whenever possible, include information about how to foster reflective practice among students in module pages and teaching examples.

## (2) Seven Principles for Good Practice in Undergraduate Education

*Seven Principles for Good Practice in Undergraduate Education*<sup>9</sup>, published in 1987, was intended to provide some basic, common-sense “guidelines for faculty ... to improve teaching and learning.” According to the *Seven Principles* guidelines, good practice in undergraduate education:

- encourages contact between students and faculty,
- develops reciprocity and cooperation among students,
- encourages active learning,
- gives prompt feedback,
- emphasizes time on task,
- communicates high expectations, and
- respects diverse talents and ways of learning.

The guidelines are based on fifty years of educational research and serve as a complement to the *How People Learn* principles discussed above. Whenever possible, module coordinators should also incorporate these practical guidelines for improving teaching and learning in module content and teaching examples.

## **I. AUTHORING TIPS FOR MODULE COORDINATORS AND EXAMPLE DEVELOPERS**

In addition to the suggestions for content provided above, there are a few good ideas to keep in mind across the module.

Pedagogic modules are pieces of scholarly work, not opinion pieces. Assertions must be backed up with references or qualified as “in my experience.” Links to the literature are the mechanism we use to move from anecdote to scholarship. Reviewers will be instructed to look for unsubstantiated claims and missing references.

Treat each page as if it is the first page visitors see when they find the module. Most users enter from Google or come from an example page. They are unlikely to see your top page first and may read only one page or the pages in a random order. Make sure that a reader can tell what your page is about at a glance, can make an informed decision as to whether to read it, and can find other related pages that may be of interest.

Consider your module as a persuasive essay, designed to hook the reader into scanning the module and delving deeper. Faculty do not respond very well to “should” statements and are more likely to use your module if it works to engage and inform them rather than to direct them.

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<sup>9</sup> Chickering, Arthur W. and Gamson, Zelda F. (1987) "Seven Principles for Good Practice in Undergraduate Education" *The Wingspread Journal*, Volume 9, No. 2. The Johnson Foundation, Racine, WI. Online: [http://www.johnsonfdn.org/Publications/ConferenceReports/SevenPrinciples/SevenPrinciples\\_pdf.pdf](http://www.johnsonfdn.org/Publications/ConferenceReports/SevenPrinciples/SevenPrinciples_pdf.pdf)

Things to keep in mind as you develop your module and activities...

**Audience.** As a module and example author, the primary audience for your web pages are faculty - those in your discipline and those in other disciplines of science, social science, engineering, mathematics and technology. Users also include faculty in the humanities, K-12 teachers, and students at all levels.

**Looking not reading.** The most important distinction between writing for paper copy and for the web is that users *read* books while they *look at* websites. Studies show that users do not read through pages linearly, rather they look first at the things that catch their eye (titles, headers, pictures and links). Users need to be lured into reading by something interesting. To this end, we encourage you to think about how a user will look at and move through your web pages to learn something. Nesting long descriptions behind pages that provide a quick overview is an important technique. Try to break up long paragraphs and use bullets where appropriate.

**Bad surprises.** The largest source of user frustration occurs when links take them to things or places they are not expecting. Users don't mind clicking nearly as much as being surprised or disappointed by where they land. Thus, it is critical to place links in contexts that help the user understand where they are going. Similarly, backward navigation, allowing the user to easily return from the page which they came from, is just as important.

**Effective use of images.** Images can be used in any section. Images provide visual appeal but should also serve a clear purpose. Often, a simple image can convey at a glance what the example will be about or give the instructor a sense of the data collected. For example, evaluation studies conducted by SERC indicate that a simple graphic to show potential data eases the instructor's effort of adopting the example into teaching practice.

**Linking.** Links can also be effectively used in any section to link to web pages within [serc.carleton.edu](http://serc.carleton.edu), external web pages, catalog records, or uploaded files. What should the link say? The verbiage of the actual link text should match the name of the page or file that is being linked. Avoid vague phrases such as "click here" or "this page" for the link name.

When including a link to an uploaded file, the file type will automatically be shown to the user along with file size and the date the file was uploaded. For example: (Acrobat (PDF) 9kB Jun17 03) or (Microsoft Word 61kB Feb16 05).

Links to cataloged records, such as Physical Geology (more info) will automatically have a (more info) link displayed following the catalog record title.

**Avoiding long scrolling pages.** Ideally, online information is easier to read in small chunks of text with short sentences and effective use of bulleted lists. In trying to keep an example on one web page, there are two ways to help the user.

One way is use of the ***hidden text tag*** for supporting content. This tag and its counterpart are used to surround text that we'd like to have hidden except when the user explicitly wants to see it. This is also how image captions are handled. An illustration of how the hidden text tag works is provided in (see the “Show Timeline of activities” link under “Agenda”):

[http://serc.carleton.edu/econ/project/webinars/mar\\_2\\_webinar.html](http://serc.carleton.edu/econ/project/webinars/mar_2_webinar.html)

Another way to handle long scrolling pages is to add '***anchor' links*** to the top of the page as a sort of alternate navigation technique. Anchor links also function as a table of contents that lets the user know what the page contains. See the following example to see how anchor links can be used to inform and direct users to relevant information on a page:

[http://serc.carleton.edu/NAGTWorkshops/petrology/teaching\\_activities\\_table\\_contents.html](http://serc.carleton.edu/NAGTWorkshops/petrology/teaching_activities_table_contents.html)

## **J. ONLINE DOCUMENTATION OF THE SERC CMS**

Still have questions? This Manual is intended to only provide an overview of the structure of the pedagogic modules and their development. There is extensive online assistance and documentation about the SERC Content Management System (CMS) available to you. We suggest that the first thing you do is make yourself familiar with the SERC CMS documentation. A good place to start is:

[http://serc.carleton.edu/serc/cms/for\\_authors.html](http://serc.carleton.edu/serc/cms/for_authors.html)

Here you will see an explanation of what a CMS is and what it is capable of doing, along with an extensive menu of context-sensitive help. This part of the SERC site should become your close companion as you begin your module development. Check here first for any questions that you have about the development of your module.

## **K. CONTRIBUTING NEW EXAMPLES**

Once the module is “live,” or made available to the general public, it will serve as a platform for further work for the pedagogy it serves. As noted above, it will be the responsibility of the module coordinator, working with the co-PIs and participants in the SERC workshop, to populate the module with additional examples. In this way, the module will grow over time, and will be a site to which instructors will return for new teaching ideas. The additional examples will be submitted by educators contacted directly by the core module team, as well as those who attend conference presentations or visit the SERC site. (First time visitors to the site will be

asked to add their names, institutional affiliation, and email address to a mailing list.)

The module coordinator may ask others working on the module, likely those who attended the workshop, to assist both in recruiting economists to submit examples and in working with these economists to improve a submitted example. Proposed examples must be submitted using the SERC example template, for which instructions will be provided by the co-PIs. These submissions will be reviewed by the module instructor for completeness and appropriate use of the pedagogy (as well, of course, for accuracy in terms of economics.) SERC staff will use the template to create a web page, likely making further suggestions for improvement. Only after the example is approved by both the module instructor and SERC staff will it be made public on the module site.

## **L. A WORD ON COPYRIGHT – CREATIVE COMMONS SHARING LICENSE**

A key element of this project is to promote sharing and reuse of teaching material among educators. In order to lower the barriers raised by copyright and the associated confusion over whether “fair use” applies, we strive to offer all the materials in our shared collection under a license that explicitly allows for this sort of reuse.



This Creative Commons Attribution Non-Commercial Share-Alike license allows for reuse of materials on the site as long as attribution is given to the original author, derivative works are offered up in a similarly free manner, and the material isn't used for a commercial purpose (e.g. included within a textbook that is offered for sale).

See <http://creativecommons.org/licenses/by-nc-nd/3.0/>

To make this happen, each contributor must grant us permission to offer their contribution up under this sort of the license. In submitting your materials you are agreeing to this arrangement. It's important to note that we assume all materials you provide (either text or uploaded files and images) are either created by you or are offered up by their original creator in a fashion that is commensurate with this redistribution. If your contribution contains materials created by others (images, documents), you must have the permission of the original author (either explicitly given to you, or given implicitly by virtue of the material being in the public domain, or offered up under some similar license) in order to contribute them to this collection.

Pedagogic modules are different from contributed examples. They are intended to be shared with the world, free to all for their use. When multiple individuals work on a module over time it is not always clear who ultimately holds copyright to which component of the module. Because our arrangement with module coordinators is a



work for hire arrangement (as implied via payments to develop the module content), SERC will hold the copyright to all materials on the Starting Point site. SERC will, in turn, offer the module content to the world under the above described creative commons license.

***Does this mean I'm giving up my copyright/ownership of what I contribute?***

No. Contributors to these collections retain their copyright of the things they contributed. They are free to do whatever they like with their materials (e.g. including it in a textbook for sale). The license contributors are agreeing to simply outline the limits of what we can do with the materials (and by extension what people who find the materials through the collection can do, without have to go back to the author and ask for broader permissions).

***Can I include the funny cartoon/useful figure I always use with my students? I copied it out of a book, but I'm an educator and that's fair use isn't it?***

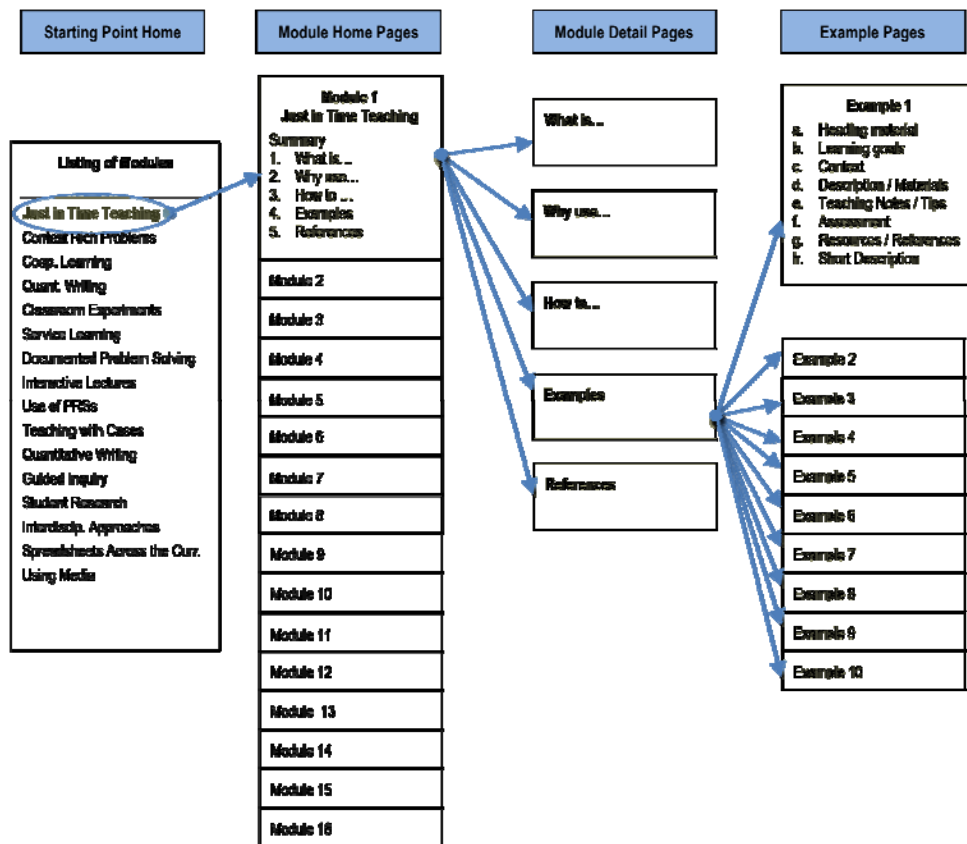
Probably not (unless you drew the cartoon/useful figure yourself). While it may be fair use to use some copyrighted materials in the context of your own classroom, it's much less clear once you start distributing the material beyond your own students. Please don't upload those sorts of materials to this site. You can often find substitutes unencumbered by copyright or simply provide a link to the original material (or a description of how to get it) rather than including the material itself.

***But I gave attribution to the original source. Doesn't that mean I can include it?***

Unfortunately not. While notions of academic honesty and the importance of attribution for establishing the intellectual provenance of work are central to academic work, they have no bearing when it comes to copyright (at least in the U.S.). If you don't have permission from the copyright holder, do not use his or her material.

## APPENDIX A: STRUCTURE OF THE STARTING POINT-ECONOMICS SITE

Below is a visual representation of the *Starting Point-Economics* site that illustrates the full set of resources that are available for each module (see the yellow boxes). Each box represents a web page on the site. Users of *Starting Point-Economics* may navigate through the site as indicated by the arrows or may jump directly to one of the pages via a web search engine or direct URL.



## APPENDIX B: COMPLETE TEACHING EXAMPLE



### How well can hand size predict height?

This page is authored by Carl Lee, Central Michigan University, which is one of the activities in the "Real-Time Online Hands-on Activities" at <http://stat.cst.cmich.edu/statact/> supported by the NSF/CCLI #0310932. The co-director of the project is Felix Famoye, Central Michigan University.



This material was originally developed through CAUSE as part of its collaboration with the SERC Pedagogic Service.

#### Summary

This activity uses student's own data to introduce bivariate relationship using hand size to predict height. Students enter their data through a real-time online database. Data from different classes are stored and accumulated in the database. This real-time database approach speeds up the data gathering process and shifts the data entry and cleansing from instructor to engaging students in the process of data production.

#### Learning Goals

This activity is designed to help students learn the issues related to data measurement and production, to learn the relationship of two variables. By the end of this activity, students will be able to

- explain the importance of data measurement and production in a given context,
- compare different measurements and distinguish which one has smaller variation when measured repeatedly,
- apply graphical and numerical techniques to describe and interpret the relationship between two variables in a given context,
- explain the least square method in a given context,
- distinguish between causation and association,
- determine if a linear model is appropriate or not using graphical residual analysis tools,

- identify outlying cases and determine the effect of the outlying cases.

### Context for Use

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- This activity is appropriate for introducing bivariate relationship at introductory level with high school algebra as prerequisite.
- This activity can be conducted as a group project, an individual project or a home work project.
- The activity is easy to conduct. The actual time for guiding students collect, enter and download the data is usually less than 10 minutes for the entire class.

### Description and Teaching Materials

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The detailed description and materials of this activity are located at the site:  
Real-Time Hands-on Activities

The following materials are used to introduce the bivariate relationship. One may choose to use a subset of the materials her/his class.

- The power point slides: used for introducing bivariate relationships. (PowerPoint 1.4MB May16 07) This is a complete set of materials for class lecture. You may already have your own lecture notes. Feel free to take any part of the slides.
- Hand size data (20 cases): (Excel 6kB May15 07) This data set is part of the hand-size data randomly selected from the activity database. This is used throughout the power point slides as the class demonstration to introduce the bivariate relationship.
- Activity Worksheet - Hand Size: (Microsoft Word 37kB May17 07) This is a set of questions that guides students to investigate how well hand size can predict height. This is usually used as a group activity. It is suggested starting the group activity during the class period (or lab sessions), completing the activity after class and turning the worksheet the next class period.
- The hand size data (50 cases): (Excel 11kB May15 07) This data is a subset of the hand size data. The questions in the Hand-Size worksheet are based on the analysis of this data set.
- Activity Worksheet - online applet: (Microsoft Word 26kB May15 07) This worksheet is for students to learn the effects of outliers and influential cases. It may be assigned as a group activity or as an individual homework activity.
- Questions for assessing learning outcomes (Microsoft Word 99kB May3 07).

### Teaching Notes and Tips

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Features about the Real-Time online data collection the instructor should be aware of:

- This activity requires students to collect data and enter their own data to an online database. Here is the instruction sheet for instructor: Instruction for instructor to facilitate the data collection. (Microsoft Word 28kB May17 07)
- The equipment for conducting this activity are (a) one-foot actual or paper-copy ruler and (b) Computer station with Internet connection.
- The best classroom setting is a computer classroom with Internet connection. Students can also enter their own data using any computer that has Internet connection after class.

Prior to conducting this activity, the instructor needs to:

- spend half an hour to navigate the Real-Time Hands-on Activities site to get familiar with the site.
- register to request for an activity code for the activity before the class.
- prepare paper rulers or actual rulers and make sure the Internet connection works in the computer lab.

During the session of conducting the group activity,

- Start with the discussion on how to measure hand size and ask students to compare different ways of measuring hand size in terms of (a) is the measurement measures 'hand size', (b) is it easy to measure, and (c) how well can it be measured repeatedly.
- Comparing Hand-length(from wrist to tip of the middle finger) and hand-width(from the tip of the thumb and the tip of little finger, when stretching out the hand), They both are valid measurements, easy to measure. Hand length is more repeatable.
- Ask students to go to the Real-Time Hands-on Activities and direct them to enter the data. See Instruction for Instructor (Microsoft Word 28kB May17 07) for step-by-step instruction.
- Ask student to make an 'educated' guess as to which one 'hand length' or 'hand width' a better predictor and their reasons. Then, make a comparison later after the analysis.
- Outlier cases may occur. For example, Based on how hand-length and width are measured in this activity, hand-width is always longer than hand-length. If a case that shows hand width is shorter than hand-length, this provide a discussion on measurement error and the effect of outliers.
- The hand-size data for the worksheet has a case with hand-width shorter than hand-length. Students are asked to analyze the data, first, without knowing this case, then, investigate the data, and delete this case, re-analyze the data and make a comparison.

The use of this activity beyond introductory level:

- This activity may be used to introduce models with both qualitative (gender) and quantitative (hand length) predictors.

- This activity may be used to introduce the concept of multicollinearity by using both hand length and hand width as predictors.
- This activity may be used to introduce variable selection techniques by including gender, hand width, and hand length as predictors.

### Assessment

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Students are assessed using

- Classroom Group activity worksheet: Activity Worksheet - Hand Size: (Microsoft Word 37kB May17 07) The data set used for this activity is The hand size data (50 cases): (Excel 11kB May15 07).

This activity assesses students' overall knowledge of bivariate relationships. In this data, there is a case that has measurement error; Hand-width is shorter than Hand-length. This error occurred when the student did not stretch out the hand for taking the hand width. Students are asked to analyze this entire data. Then, they are asked to locate this measurement error case, identify at least two more possible errors that may occur. Delete the case, re-analyze the data and make a comparison.

- Activity Worksheet - Using an online applet (see reference for the source): Activity Worksheet - online applet: (Microsoft Word 26kB May15 07) This activity assesses their understanding of the effects of outliers and influential cases. It may be assigned as a group activity or as an individual homework activity.
- Questions for assessing learning outcomes (Microsoft Word 99kB May3 07). This is a set of multiple choice questions for assessing learning outcomes at the end of the topic or used for final exam. It does mean to use all of them at once. You may choose any subset of these questions for your class.

### References and Resources

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- Real-Time Hands-on Activities site: This site consists of the detailed description of this activity, and all of the materials related to this activity. In addition, there are several other real-time online activities available on this site.
- Online Applet for Bivariate Relationship. This applet allows students to create their own scatter plots, observe and compare the patterns and correlation coefficients as well as least square lines. It is especially useful for students to create different situations involving outliers and observe the effect of the outliers.

Source: <http://serc.carleton.edu/sp/library/cooperative/examples/18172.html>