Active Learning and Feedback Patterns

Version 3

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Introduction to Pedagogical Patterns

Pedagogical patterns, like all patterns, attempt to capture expert practice. In this case it is the practice of experienced teachers, both in academia and in industrial settings. The four patterns in this paper propose successful techniques to assist with teaching and learning. For many professional educators, these patterns may at first sight seem obvious, even trivial. However, all educators both experienced and novice will benefit from the ideas contained in these patterns. For those newer to teaching pedagogical patterns offer a way to receive the wisdom passed on by experienced teachers. But even the experienced will benefit from patterns because they offer a way to learn from one another and to communicate good ideas with each other. This is, of course, because Nobody is Perfect [VF], and furthermore everybody has developed her own little secrets that she can share.

The pedagogical patterns project [PPP] is working on collecting many types of patterns that can help teachers teach and students learn. This collection demonstrates recent efforts by members of the project.

These patterns are based on ideas communicated by active teachers at a recent conference. They are written in Alexandrian form in order to support the integration into a pattern language. The work continues and additional patterns will be submitted to future conferences of the PLoP series.

The Pedagogical Patterns Project

Most educators and trainers are not taught how to teach. Rather, they often find themselves teaching by accident. Typically, a person with a skill that is in demand, such as a particular programming language, will be asked to teach it. People assume that if the person is good in this programming language, she will be good at teaching it. But knowing the subject matter is very different from knowing how to teach it. Moreover, the successful teaching techniques of non-technical fields may not be known to many instructors of technical subjects, though they may well apply.

Effectively communicating complex technologies is often a struggle for information technology instructors. They may try various teaching strategies, but this trial and error process can be time-consuming and fraught with error. Advice is often sought from other "expert" instructors, but these individuals

are not always readily available, nor do they often reflect on why they are successful. This creates the need to find other ways to facilitate the sharing of teaching techniques between expert and novice teachers.

This is the goal of the Pedagogical Patterns Project (PPP, [PPP]). Pedagogy is a term that refers to the "systematized learning or instruction concerning principles and methods of teaching" [Web]. Patterns provide a method for capturing and communicating knowledge such as pedagogy. As an example, imagine that you are looking for an effective way to teach message passing to experienced programmers in a weeklong industry course. A friend who is teaching a semester-long object technology course to traditional age university students has found an effective technique. He shares it with you without dictating the specific implementation details. This allows you to use your own creativity to implement the technique in a way that is most comfortable for you and most useful for your industry students. This is the essence of patterns – to offer a format and a process for sharing successful practices in a way that allows each practice to be used by a variety of people in many different ways.

A collection of patterns could form a repository of techniques for teaching a specific subject, such as object technology (OT), or for covering a particular aspect of pedagogy (as in these languages). Ideally, many of the patterns would have an even broader scope than OT, but all of them would be useful in many different training or learning environments because they are proven teaching techniques.

But even this is not the end of the story. Related patterns can be combined in either a pattern catalog [Bus] or in a system of patterns [Fow]. A third possibility is to relate several patterns within a common problem space, the result of which is a language of patterns that provides a resource for solving complex problems. The goal of the project described in this paper is to form pedagogical pattern languages for teaching. This will provide instructors with the ability to share their effective teaching techniques in a common format, to document relationships between the techniques and to form powerful tools known as pattern languages.

The Pedagogical Patterns Project (http://www.pedagogicalpatterns.org) is a continuing endeavor. We invite all interested parties to join in these efforts to capture expert practice in a transferable way.

The Pattern Language

The patterns in this collection use a form similar to the one used by Alexander in his book A Pattern Language [CA]. All patterns are written in the you-form, thus directly talking to you, the teacher. In addition to the pattern name, each pattern is divided into four sections. The sections are separated by ❄❄❄. The first section sets the context. The second describes the forces and the key problem. The third section outlines the solution, the consequences, limitations and disadvantages. The fourth section complements the discussion of the

solution, by providing further information and examples. The key problem and the solution are in bold font and represent the thumbnail of the pattern (also called the pattlet). The examples are in italic font. References to patterns inside this pattern language are in CAPITAL LETTERS, references to patterns published elsewhere are in normal font, but followed with the [pointer] to the reference section.

In addition, each pattern is marked with one or two asterisks (*), as in Alexander's patterns. They show how fundamental we believe the pattern is.

Two asterisks denote patterns that state a true invariant. We believe that it is not possible to solve the stated problem properly, without referring to the solution that we have given. One asterisk means that we think that we are on the right track, but we believe it will be possible to improve the solution.

It is intended that these patterns merge into the earlier work of the Pedagogical Patterns Project, In particular, into the Feedback and Active Learning collections.

IMMEDIATE FEEDBACK *

This pattern was written by Joseph Bergin.

You are conducting a lecture or other teaching activity. You want to know immediately whether the students believe they have grasped the essence.

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You need to know whether it is time to move on to the next topic or activity, or whether your presentation has lost many of the students. If you plunge ahead when many students are not ready you will lose them. But if you continue on the topic when the students already "get it" then you are likely to bore them.

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Therefore, provide some immediate feedback mechanism from the students that lets you decide whether to go on or review.

There are many ways to achieve this. The traditional way is simply to look for raised hands or to ask if there are any questions, but this is well-known to fail in some cases and with some students. There are now technological means if you can use them. One is a clicker mechanism that will send a signal to the instructor's PC. The signal can be anonymous and aggregated automatically. With such a mechanism you can continuously probe the students for feedback. This can also be achieved with an Instant Messaging mechanism (though not anonymously) or a wiki. A less technological mechanism is to pass out red, yellow, and green cards to each student. Students can signal you with these on your request. This is useful in large groups and where anonymity is less important.

On the other hand, if you are rich enough to have networked laptops or tablet computers, the student might only need to click in a box on the screen.

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The question then arises, what to do when some students indicate their lack of understanding. You can, of course, react differently to different proportions of understanding/not understanding students. For example, if it is only one or two, you might have a short, paired, exercise that will solidify the understanding of everyone. If the signaling is not anonymous, you can note who has trouble and arrange extra help. Even if not, you can ask the negative replies to see you for a few moments after class. If many don't understand, you might review the material, or have a more elaborate group exercise, such as a role-play, to improve understanding. This pattern, therefore, can be thought of as a bridge between feedback and active learning.

Be concerned about cultural issues in the application of this pattern. In some cultures it might be interpreted as criticism or questioning of a superior. In such situations, you will need to make this "safe" for participants if you decide to use it.

You may also need, in some situations, to limit the quantity of feedback so that you aren't continuously interrupted, frustrating some students. In particular, you may need to control when the feedback occurs or is acknowledged.

FINAL LEARNING CHECK *

This pattern was written by Joseph Bergin.

You are ending a lecture or, in any case, the days activities. You want the students to take a moment's reflection on what has occured in that session.

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Many times an individual class will have many parts, some of which are complex. **If the session simply ends and students go on to other things, they may quickly lose what they have learned.** Too typical is to have the ideas in the notes, but not in the head.

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Therefore, take a few moments at the end of the class to have the students reflect on what occurred.

This is best done if you ask the students to **Explain It Yourself** [EBS]. It is less effective if the instructor simply recaps the day's discussions.

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This might be achieved by passing out an outline of the topics of the day and saying a few summary words about each topic. An even simpler mechanism is just to ask: "Did anyone learn anything today?" If you simply wait a few moments to see if heads start to bob or shake, you will learn something about your effectiveness and they will have a moment to quickly reprise the day. If

you go farther and ask for quick comments on what was learned, it will be even more effective. This can be done by asking for volunteers, or by going **Round Robin** [EMWM].

This ritual can also make the eventual course evaluation more positive, as they have been thinking each day about what they learned. The author uses this to end each class and often lets the **Students Decide** [BEMS] on the topics to be initially covered at the beginning of the daily class. Together they form nice bookends for the session.

The same learning check can be done at the beginning of the following session. This might be especially useful if the topics from before flow into the current discussions. You can also do this at the end of a topic rather than at the end of a day. It is also useful, at the end of the day, to point out what from today will be especially important in the next session.

STUDENT EXTENDS

This pattern was written by Joseph Bergin, based on a talk by John Hamer and Ed Gehringer.

You are designing activities for your students. You want them to do meaningful work in in the course.

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Students and instructors often find that the provided materials don't meet their needs. Textbooks are often only an approximate match for the course content. In a rapidly changing field, there may simply be no adequate materials. **In addition, many student activities, such as most homework, have no intrinsic value other than as etudes to get a student to practice.** Thus, students don't get a sense of what "real work" is like. If a student recognizes this, it may lessen his or her commitment to the work, as it then seems like mere "busy work." It seems a shame that all this student effort winds up ultimately in the rubbish.

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Therefore, involve the students in improving the classroom materials. For example, ask them to provide a better explanation of a topic than can be found in the textbook. Or ask them to write an example of the use of some topic or an exercise to test it.

Another variation is to have students take class notes and post them on the course wiki[1]. This is, perhaps, best done in pairs or small groups. The interactive nature of the wiki then lets others contribute. This involves the students in research, which can add a special dimension to your course. It also makes them write in the language of instruction and to refine their writing. It

[1] A wiki is an interactive web-site in which any visitor can edit any page. The Wikipedia may be the best known example: http://wikipedia.org/

might even be possible to bring in writing experts to help the students be most effective. Team teaching with members of the English (German, …) department might be advantageous.

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It is best if these materials can be published in some way. A wiki can be used, but the results could, in come cases, feed into a real textbook supplement for future students. This will get the students engaged in the materials, as well as give them a sense of ownership.

The activities can be done in groups or individually, though they are probably most effective when done in small groups. Consider the maturity level of the students when you do this, though the original implementation known to the author was with novices.

The impetus for writing this pattern was a panel held at SIGCSE '06 titled "Active and Cooperative Learning: Beyond Pair Programming and Group Projects".[EG} The panel was led by Ed Gehringer of North Carolina State University. One of the participants was John Hamer of the University of Auckland. Ed also has students peer review such materials.

Jeanine Meyer, then on the faculty of Pace University, taught a course jointly with Martha Driver, an English professor. The topic was a combination of early English literature (Beowulf to Lear) and web development/multimedia. Jennifer Thomas later adopted the course. http://csis.pace.edu/grendel/

This pattern is a variation on **Real World Experience** [BEMS].

ICEBREAKER **

This pattern was written by Joseph Bergin. It extends **Open the Door** by Jutta Eckstein [JE]

You are at the beginning of a course in which group work and interaction will be important. Perhaps your students don't know one-another well.

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If the students don't know one another their early interactions will be awkward and they will have little trust in one another's abilities to contribute. Group work depends on trust as well as knowledge of abilities. Group work also depends on the students being active in the group's activities. Yet most courses don’t give them a lot of practice in interacting with one another. On the other hand, they are initially reluctant to step out of their shells and may feel there is risk in interactions with other students.

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Therefore, provide an icebreaker activity at the beginning of the course to give students some knowledge of one another and to begin to build trust.

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The author often uses a game learned from George Platts [GP} who is Games Master at the EuroPLop conference (and others). Students stand in a circle that includes the instructor. The instructor gives his (or her) name and names an activity that he likes along with some characteristic action of that activity, such as kicking a soccer ball. The activity is performed with some gusto. The person to the left then repeats the name, activity, and action of the instructor and then gives one of her own: name, activity, and action. It then goes around the circle with each person naming all previous participants and performing all of the previous actions followed by his or her own name and activity. Each person learns a bit about everyone else.

If the students already know and trust one another this may be counterproductive and simply waste time, though **Open the Door** may still work. It may also be possible to take advantage of their earlier work together. There may be cultural situations in which this patterns should not be used. Also, this pattern does not address trust between the students and the instructor. If it is carefully used, however, it might enhance student trust in the instructor, but consider this question carefully in application.

It is also possible that an unsuccessful application might lower trust among the students. Watch for this and provide a follow up discussion or exercise (a retrospective) if you notice this. On the other hand, if it is too successful it could possibly lead to the formation of cliques within the group that might not be in accord with your overall goals.

Keith J. Whittington of Rochester Institute of Technology has the students pair off with strangers who then interview each other with a given set of questions. They then visit a neighboring pair and each person introduces his or her new "buddy." This technique was also presented at Ed Gehringer's panel mentioned above.

Note that **Open the Door** [JE] is more focused on the topic, whereas this pattern deals primarily with the need for effective group process.

In the Doctor of Professional Studies program in which the author teaches we use very elaborate Icebreaker exercies to introduce the students to each other and build teams. The teams do tend to be a bit cliquish, though that doesn't impact negatively in our case.

Thumbnails

The following patterns are not part of this language, but they are referred to by one or more patterns above.

> **EXPLAIN IT YOURSELF** [EBS]
>
> Because topics are complex, the students may be able to repeat definitions and other material verbatim without real understanding. They might also not be able to extract the key ideas from the supporting material.

Therefore, invite the students to express the key ideas using their own words. If a student uses her own words you will be better able to judge the level of real understanding.

OPEN THE DOOR [JE]

You want to begin a course in which the participants are strangers both to themselves and to the topic of the course.

Therefore The participants introduce themselves in a way, which at the same time provides an introduction to the topic.

REAL WORLD EXPERIENCE [BEMS]

A lot of concepts are too abstract for students to conceive their value. And even worse students often doubt the viability of these concepts. Assigned problems or lab projects help to make those abstract concepts more concrete. However restricting students to lab environments deprive them of exercising the issues in their rightful habitation – namely the work place.

Therefore involve the students in real world situations, by inviting them to accomplish a project in a real world environment. Involving a domain interest allows the students to experience the real project life, from the time pressure of a deadline to the pride of demonstrating the result.

ROUND ROBIN [EMWM]

One of the most difficult aspects of teamwork is getting everyone in the room to work on equal footing. However, you want to get everyone's participation and input and you especially want to encourage the quieter members to take a more active role.

Therefore, use a round robin technique to solicit suggestions.

STUDENTS DECIDE [BEMS]

You want to take the participants specific interests into account, but you are not completely sure about how to do this regarding the contents, the schedule, or the methodology. Sometimes it is impossible, to make decisions concerning course material and approach in advance, because the exact skills or interests of the participants are not known. If the students are more engaged in the process they may be more engaged in the material as well.

Therefore, involve the participants in the planning of the course, or suggest some alternatives at the beginning of the course. Give them a voice in choosing among the alternatives. This allows the participants

to shape the course. Involving the participants in these important decisions makes the course more relevant to them.

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