

Reciprocal Leading: Improving Instructional Designs in E-Learning

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1. Introduction

This chapter discusses new approaches for e-learning instructional designs in distance learning and virtual settings. Called reciprocal leadership, students under the direction of an instructor take turns in leadership roles at distributed locations in person or virtually via synchronous social media sites, through facilitating groups and developing leadership skills. Three approaches of reciprocal leadership for e-learning are discussed and examples presented: structured, unstructured and semi-structured reciprocal leading. The approaches are useful in addressing the difficult challenge for both distance and hybrid e-learning courses of how to facilitate interesting and effective group interaction.

One of the most difficult challenges for both distance and hybrid e-learning courses is how to effectively facilitate group interaction. Student centered designs that focus on learners constructing understanding often employ small groups for reflection, dialogue and interaction (Bransford, Brown, & Cocking, 2000). Effectively facilitating multiple groups in e-learning, whether synchronously or asynchronously, requires different approaches than in the traditional classroom (O'Neil, 2003; Thompson, 1999). The three reciprocal leadership approaches discussed here are explored in several contexts, and implications are discussed.

Assigning students to leadership roles as part of class activities is nothing new (Olson & Torrance, 1996). But in e-learning this group facilitation can take on both new urgency and a new look (Clark & Hooley, 2003; Taylor, 2002). The new urgency comes about because distributed groups often stumble in carrying out small group activities when the instructor is not physically present. Special preparation and strategies are necessary to make it work well.

One of these strategies, reciprocal leading, rotates students in the role of leader. Students take on facilitation roles as well as sometimes teaching, organizational and other responsibilities at distributed sites or in virtual activities. Reciprocal leadership can increase successful group interaction, be very engaging for students and reinforce emerging leadership proficiencies for students. Here we discuss three approaches for reciprocal leading in e-learning, and compare some strengths and weaknesses. The three approaches differ in part in the degree of structure applied to the leadership role, with a structured, semi-structured, and unstructured example discussed here.

2. What we mean by reciprocal leading

The term reciprocal leading is used here as a parallel term to reciprocal teaching. Reciprocal teaching (Palincsar & Brown, 1985) is an approach to instruction originally created to help with reading comprehension. Classrooms were organized into small reading groups, with one member of the group assigned to act as the teacher for each reading. He or she was responsible for holding a discussion about what the article, story or other writing meant. Although every member of the group was expected to complete all readings, the reciprocal teaching role rotated to a new person for each reading, until all members of the group had a chance to “teach” a reading.

Reciprocal leading broadens this role to include not only teaching but taking turns monitoring and moderating group activities, facilitating, organizing and leading groups. Leaders rotate and often a new leader is selected for each class session or reciprocal activity. For e-learning, goals can include that all members of the group experience the leadership role as well as that more facilitation and leadership capacity is available across distributed and virtual sites. Group activities that can be led with reciprocal leading strategies including many collaborative learning and small group designs, online or offline.

Reciprocal leading, like reciprocal teaching, can serve numerous purposes and functions in different learning environments. Though not yet a common topic in the education literature, mentions of reciprocal leading are beginning to be discussed (Michigan State University Extension, 2007; Sawicki, 2003). In general, the concept of leadership in general at least in the U.S. where we are situated is moving toward increasingly a distributed organizational responsibility with shared accountability for affecting system change and improvement (Kaufman, 2007). Reciprocal leading acknowledges the leadership roles that students can take in a distributed community of learners.

In the original design of reciprocal teaching, the reciprocal teacher begins by asking the group a question about the article and ends with summarizing the article. The basic elements of reciprocal teaching often are categorized as involving questioning, clarifying, predicting and summarizing activities.

The basic elements of reciprocal leading center around facilitating and mentoring group behaviors. The basic goal of facilitation is to help a group accomplish its goals. Understanding group dynamics, the roles that individuals play in groups, and guidelines for facilitation are all principles that can be taught. Basic facilitation skills include preparation and planning for group work, establishing ground rules, staying on task with work goals, methods of intervention when groups need to move in new directions, data or other product management within the group, and presentation of deliverables. As reciprocal leaders become more skilled, they can grow in their ability to lead by considering such topics as how rigid or flexible should the structuring of group activities be, what should the pace of activities be, and to whom should the group look for checking and validation of their work, such as whether adjudication should be internally or externally focused.

2.1 Some strengths and weaknesses of reciprocal leading

The idea behind reciprocal teaching is that during peer-to-peer discussion, problems of understanding often come to light. One student attributes meaning to a part of a reading,

and others bring their thoughts and reflection to clarify or refocus the meaning. Thinking is externalized in the discussion.

Similarly in reciprocal leading, a type of meta-thinking is externalized. The facilitator moves between groups and can compare and contrast approaches between and among groups. Since the facilitator is a classmate, peers are often more generous in their inclination to cooperate with the group task, and to discuss approaches or seek alternate solutions. The search for common ground helps ensure that students are finding best approaches in a very situated fashion.

Like in reciprocal teaching, in reciprocal leading more skilled and less skilled members of the group can participate together. In a reading setting, group members with a range of skills can participate together as initial reading is done outside the group, at everyone's individual pace. But then the group forms to share opinions about what the reading means. Peer-to-peer instruction helps to clarify parts of the reading that may not be understood. Additionally, participants can point out passages that are meaningful to them and situate the learning in the local context by sharing personal experiences, ideas and thoughts. In the end, the reading task is ultimately simplified not through decomposition into basic skills but rather by providing a variety of expertise from the group to negotiate meaning.

When doing reciprocal leading, once again the temporary group leader has access to all the skills of the group to clarify activities, suggest guidance and provide a rich variety of expertise. Like reciprocal teaching, reciprocal leading serves multiple purposes. First, it is a distributed learning design that allows complex activities to be carried on by inclusive groups, without requiring the continuous presence of the teacher or course instructor. This makes it a good choice when there is only one teacher present for many students. Small groups can differentiate instruction naturally, since the leader-teacher-student ratio is reduced to a level where everyone's understanding can be addressed.

Reciprocal leading also gives students more opportunities for leadership experiences, even at early ages such as middle school. In reciprocal teaching, a consistent theme throughout the variations of the approach is that the teaching role is assumed by the students, and that this teaching role rotates to all members of the group. It is distinguished from some other forms of peer tutoring by who gets to assume the teaching role. Other forms of peer tutoring often involve specifying one or more peers as more capable – the tutor – while others are the learners, or tutees. Reciprocal leading offers some of the same egalitarian advantages to training who leads, and to showing that the leading and following roles can rotate to everyone within a group.

Encouraging students to engage in leadership experiences can reinforce key habits of mind as well as group interaction skills. Rotating the leadership role helps to break students out of group roles they may have become identified with in the regular school social context. It can also provide sheltered environments for language learners and international students, for instance when a native speaker or domestic-born reciprocal leader is assigned to facilitate groups that may need assistance in understanding some specific terms in English, if that is the language of instruction, or to offer a local perspective on policy, structure, organization and so forth if that is pertinent to the learning goals. The opportunity to exchange information across cultural or national contexts through the reciprocal leading role is powerful for global education, we have found, helping both the temporary leader and those

in the supported environment. When roles shift, in this case the language learners and international students can then take a lead position in an area of their own expertise. For instance we found this last year in University of Oregon classes with a German student to the U.S. holding a graduate degree in an important areas of cognitive psychology for our class, and a Korean student who was able to lead us in podcast creation activities for shared learning using her enlightening social media skills, while the international students each enjoyed a supported language and cultural environment at other times in the course, through swapping reciprocal leading roles. This draws on the strength of the class, especially for adult learners but also possible for younger students.

By specifically teaching students skills in how to facilitate group interactions and offering them leadership experiences in doing so, students gain valuable skills they can use in moderating interactions across groups. Group facilitation skills such as these are important in conflict management and in allowing many students to become “ambassadors” of leadership in and out of school settings. Rotating leadership reinforces an expectation that all students can lead. Instruction and practice in developing leadership skills builds confidence. Like reciprocal teaching, reciprocal leading can have a lot to offer students and classes.

There are also substantial weaknesses in the reciprocal leading approach. Some of these are the flip side of the strengths. While students may gain leadership capabilities as they take on leadership roles, this also presumes that students may not have these proficiencies to start. Calling on students to lead activities that they are just mastering themselves can be a challenge. It places demands on the confidence of the reciprocal leader, who can feel they are not sufficiently expert to lead such activities, and also can impede the success of the group if the reciprocal leader indeed does need more knowledge or skills to lead the activity. Establishing trust, encouraging participation, organizing the work of teams and redirecting group focus that goes astray are all complex skills to ask of students. Implicitly acknowledged group roles that are already present *de facto* in some classes may also derail the efforts of students to lead. Of course, the age and maturity of students may enter into the picture. But the challenges and expectations of group tasks also tend to grow over time so the challenge to leadership abilities also tends to keep pace with growing maturity, meaning that leadership can remain relevant early and then grow even as stages of development and skills advance.

Some students may also simply not be comfortable in the leadership role. Self-confidence, shyness and a variety of other attributes can influence student anxiety. Reciprocal teaching often handles this by encouraging students to participate, while creating both a supportive environment and an expectation that all students will be able to participate, which would also be appropriate for reciprocal leading. Differentiation strategies can also be used, if necessary, to meet the needs of students, such as offering enough of an array of tasks for choices that may suit individual needs and preferences, while also offering leadership experiences.

With reciprocal leading, the variety of leadership expertise within the class can be tapped to make an intriguing array of student-centered designs possible. Here we take up a few examples in distance learning in higher education.

3. Three examples of reciprocal leading instructional models in e-learning settings

The three examples in this paper draw on different degrees of upfront structuring of the student leadership roles. They also show different synchronous and asynchronous uses of reciprocal leading.

3.1 Example 1: Traditional reciprocal teaching as reciprocal leading in e-learning

In the following example, a form of reciprocal teaching was reframed into reciprocal leading for use in a hybrid distance education course on research methodology. This course is part of a larger graduate-level program in Educational Leadership in which a portion of the students attend classes on-campus with the instructor and another group of students attend off-campus via video streaming. In this context, students at each site often form collegial relationships with other students at their site but frequently do not interact with students across sites, thereby limiting the collaborative nature of whole-class interactions. To facilitate and encourage cross-site communication and discussions, online reciprocal leading groups with members from both sites were formed to discuss the weekly readings.

The purpose of the reciprocal activity was two-fold. First, the discussion groups were designed to stimulate students' thinking about course topics by engaging in critical discourse about the readings. Second, the discussion groups were intended to encourage students from both sites to meaningfully interact with each other and develop professional relationships. To accomplish these goals, the instructors formed the reciprocal leading groups at the beginning of the course to reflect a balanced composition. Each group of five students represented approximately equal numbers of on- and off- campus students, new and returning students, and males and females. Students remained in the same group for the length of the term.

The online reciprocal activity described here was conducted in much the same way as traditional reciprocal teaching experiences, with a leadership element added. Each student assumed the role of the leader for one reading assignment while the other students participated as group members. To initiate the discussion, the reciprocal leader wrote and posted to a virtual discussion board a summary of the readings, a synthesis integrating the readings with other course topics or readings, and discussion questions that were designed to extend the readings to other contexts or situations and encourage thoughtful analysis. Group members were responsible for reading the assigned material and responding to one unique discussion question. All group members had access to and could comment on the postings. After the group members responded to the discussion questions, the leader rejoined the discussion with specific feedback to individual group members that offered another perspective, integrated responses from different group members, or provided clarification about the readings or application of the material. As such, the reciprocal leader moderated over the course readings, providing students with opportunities to seek clarification, apply the readings to address novel situations, and interact with each other.

We found that though many of the students in the course were familiar with hybrid e-learning from previous classes, they first expressed considerable anxiety with the hybrid reciprocal leading format. Concerns included whether it would be complicated and time-consuming to participate in the leadership activities, and also whether they would be able to

sustain the activity without direct intervention by the course instructors. However, as students engaged they became much more comfortable.

Group discussions did occur independently of the course instructors in the reciprocal leading format. The instructors monitored the content of the discussions for appropriateness and alignment with the assignment expectations; however, the course instructors did not join the discussion or provide feedback to group members on their engagement in the discussions. The reciprocal leader received individual feedback on his or her summary, synthesis, and discussion questions. The leader received full credit for the summary if he/she described the main theoretical issues presented in the readings, included the major and relevant findings or conclusions, and included details from the text. The synthesis was evaluated based on the analysis of the main issues as well as the integration of multiple sources into a unique perspective. Lastly, the leader received feedback on the ability of the discussion questions to elicit higher order thinking, extend the discussion beyond the perspectives described in the article, and prompt students to relate the information to other contexts and/or situations. Because the discussions occurred outside of class and required group members to react, timeliness of the initial posting and responses was also evaluated.

Overall, the student leaders successfully completed the reciprocal activities within the appropriate timeframe and actively engaged with their group members in discussion and clarification. Most earned satisfactory scores for their summary, synthesis, and discussion questions. The online discussion sessions facilitated by the reciprocal leaders were interactive and dynamic. The leaders generated thoughtful questions that were responded to with equal care. Many of the interactions exceeded the course instructors' expectations in length and depth, indicating that the discussions were engaging both the leaders and students.

Following the reciprocal leading episode, the course instructors facilitated a whole-class discussion about the readings to further clarify the topics and situate the discussion in the course content and goals, promote discourse across groups by inviting the reciprocal leaders to discuss unique perspectives or thoughtful applications generated by their group, and generalize the material across contexts. These discussions enable class members to learn from other groups and develop a broader understanding of the material. Furthermore, these activities help develop verbal and written communication skills necessary for discussing complex issues. As such, the reciprocal activities as well as the whole-class discussions contributed to the community of learners in which everyone worked together to develop expertise and problem solving skills.

Through the use of a virtual discussion board, the reciprocal leading activity described above provided an avenue for accomplishing the course objectives within a distributed distance education environment. The reciprocal leader was the instrument through which students engaged with the course readings and gained a deeper understanding of the course content. Additionally, the reciprocal leader encouraged collaboration and communication within his/her group by helping group members make connections to each other's thinking and bring clarity to their own thinking. Because the reciprocal leader changed with each reading assignment, all members in the class experienced the role of leader, thereby gaining additional leadership and facilitation skills.

While student leadership was quite successful in this course, another course using a similar but different reciprocal leading activity found a weak link when including a stage in which

the reciprocal leaders responded to the student postings. In other words, the reciprocal leaders were successful in creating and posting the synthesis and discussion questions, and these materials elicited good group response on target for the reflection and discussion expected for learning goals. However, in this second course, having the reciprocal leader then respond to and facilitate this discussion rather than returning to the course instructors as in the first example did not work as seamlessly. This pointed up weaknesses in the ability of the students to “stretch” their skills and synthesize the material in areas where they themselves were also learners. One possible explanation for these differences is the varied student demographics between the two courses. The first example described above was offered in an Educational Leadership program, while the second course was with pre-service teachers with may have had fewer leadership experiences in the past. Differences in career goals across these two student groups could have accounted for some of the different outcomes, and this suggests more coaching and practice may be needed for some students in reciprocal leading settings; however, these students also may be most likely to benefit from enriching their leadership skills and knowledge, through such supported practice opportunities.

3.2 Example 2: Paper discussion threads as a semi-structured reciprocal leadership role

Another e-learning strategy for increasing communication and collaboration across students in a distributed distance education model is to use student work to lead ongoing discussion threads to highlight specific topics. In this example, the online discussion thread was used as a venue for sharing students’ writing samples.

In a separate assignment, students were required to read a research article of their choice and provide a critique on the quality of the theoretical framework, methodology, results, and discussion using the course framework as a guide. After students received feedback from the instructors, they were encouraged to share their written perspectives with their classmates on a discussion thread. Once a student posted his/her article and critique, classmates were invited to provide a thoughtful and constructive response to the author that reflected on the author’s use of vocabulary and concepts discussed in class. In addition, students were encouraged to consider differences in writing style, research traditions, and topical themes. In providing these responses, it was the intent of the instructors that the students would develop and refine their vocabulary of research-related terms, seek clarification of concepts where necessary, and have exposure to multiple styles of communication.

This reciprocal leading approach was somewhat less structured than in the first example, where specific discussion questions were required to be generated and used to frame the group responses. Here, the threads provided a looser guide to the leadership format, and allowed a more fluid exchange of ideas.

In the end, the discussion threads uncovered a variety of patterns in the responses. Many students engaged in discussion about the topic of the original article, either seeking clarification about the purpose of the article or the methodology that was used. Several students suggested ways in which the original article could be improved or replicated. Others commented more specifically on the student’s critique of the article, suggesting ways

in which he/she could improve the presentation of the material, recommending other readings, or asking for more details about why certain recommendations were made and how they would address the shortcomings. Below are excerpts from three discussion threads that highlight these instances.

3.2.1 Critique A

Classmate response to author of critique: I really liked your critique. As a practitioner, I would read you. Your presentation is very user friendly and your logic is easy to follow. I thought that you provided an excellent summary of the strengths and limitations of the study and you acknowledged what was also included in the original article.

You mentioned limited literature in the review. How would you have expanded the search, or what would you have included? Sounds to me like they are attempting to put a new slant on an old idea and by so doing, add to the literature and what they did sounds reasonable. I just ask the question as it is often a challenge for me. I often select subjects for which there is relatively little literature.

Our district is one that is examining the idea of smaller schools, specifically the K-8 route. I agree with you that I'd like to see more research before taking these ideas into implementation. Where would you like to see this research go next? I'm a bit surprised that there aren't more cost/benefit analyses on this issue with education dollars being scrutinized so.

Author's response to classmate: In response to your questions: You make a good point that there should be more cost-benefit studies on the issue of school size. I think there are more. What makes this [article] unique is the focus on cost per graduate rather than cost per pupil. Also, the authors say that most previous studies do not have access to school level budget data (only district-level data). So other studies haven't been able to use the school as the unit of analysis.

Classmate's response to author: It's a great and novel perspective. I enjoyed reading your critique from that angle (graduate). Are you entertaining a dissertation topic in that area, or still mining?

3.2.2 Critique B

Classmate response to author of critique: I chose your critique because I, too, am very interested in how to turn reluctant readers into avid ones. A few reactions: 1) I would have expected the author to employ reading aloud to the Caribbean youth as a way to pique their interest; 2) I don't see much of a difference between reading magazines, the internet, comic books, the sports page, and novels – who cares, as long as a student is learning by accessing the text, my intuition tells me that there should be solid literacy gain through reading; 3) It looks like a fun study to try and replicate . . . particularly the Caribbean component.

Well done! I didn't know we could do the final draft in an outline format. That was interesting to see.

Author's response to classmate: Thanks for the feedback. Yeah, I remember [the instructor] saying we could use the outline format. I even have it in my notes. It kept it clean and tidy for me.

My biggest beef was that [the intervention] was 45 minutes once a week - with REALLY reluctant readers (they told me [the author] so, which told me that they [the students] had something to prove to me [the author]). Scarcely enough time to put a dent in their reading. But yes, I remain convinced that high-interest reading in any form can have an impact.

3.2.3 Critique B

Classmate response to author of critique: I don't have a lot of feedback, but here's what I have! First, just knowing a little about your background and interests, this article seemed to be a really good match.

My only other question is was this really action research? I may be mistaken in my definition, but I thought action research was done by a practitioner at his/her own school site. It doesn't sound like that was the case here because I thought you mentioned something about how the school was chosen. I probably just need more clarification on the definition and perhaps reading the article makes it more obvious! It sounds like all the other methods were aligned with that type of research.

Author's response to classmate: That's a great question. Action Research can be done in cooperation with a researcher, but the practitioner will be on the front lines. But you are correct in that it's conducted in response to a need or problem. Information is gathered, a plan constructed, implemented, results reviewed, plans adapted and the spiral continues. It's not often the type of research one would see in a peer-reviewed journal, and from what I understand definitely not the type of research one would do her dissertation around. But, from a teacher-researcher perspective, where change happens organically, it makes sense.

3.3 Example 3: Cascading as an unstructured reciprocal leadership role

The final example of reciprocal leading we will share here, which we call "cascading," was the least structured. In the first two examples, specific reciprocal leaders were identified by the course instructors and tasks assigned to the leaders. In the first example, groups were carefully formed by the course instructors and tasks including direct discussion questions were specified as required of the reciprocal leader. In the second example, the threaded reciprocal leading role was somewhat looser. Dialogue and conversation tended to move in the direction of the group interest, with less specification both by the course instructor and the reciprocal leaders. In this third example, the reciprocal leader may not be designated at all, nor their tasks clearly defined. Rather, students coalesce into groups more naturally of their own accord, as described below, to achieve a small objective that has a clearly defined goal: solve a statistics problem, learn how to use some aspect of a software product, complete a portion of a laboratory activity. Generally, some groups at each site may identify the solution more quickly and achieve the objective before others. This can result in sites where some students are impatiently waiting to go on while others are still struggling with basic procedures or problem setup.

In cascading, this differential pace is turned from a problem into an advantage. While participating in cascading designs, those students who have completed a task, project or subgoal successfully then move briefly into the role of reciprocal leader and join other teams to facilitate their work. Productive dialogic inquiry often results, with those who join groups querying the group about what they have tried and what problems they are encountering.

Having just been successful on the task themselves, the reciprocal leaders become a valuable body of expertise for the striving group. The term *cascading* is used because the expertise then cascades throughout the distributed site, either offline or online, with problem solution propagating multiplicatively as one successful group can readily divide and disseminate their knowledge, to assist two, three, four or more other groups or individuals.

The term “cascading” is drawn here from the biological sciences, where the process of cascading is found in many living systems to speed them up and to amplify the impact of the result, on a molecular level such as in chemical pathways of the body. This concept of cascading, or propagating change multiplicatively by dispersing groups of change agents, allows some of the fastest biological processes in living systems to occur. Here in this application of reciprocal leading, we apply the mechanism to social systems, for the purpose of increasing learning opportunities for all students, in a way that can help support distance and virtual education.

Cascading is a form of differentiated instruction for students. Differentiated instruction is an approach to teaching that acknowledges people have multiple paths for learning and for making sense of ideas (Hall, 2002; Reis et al., 1988; Sizer, 2001; Tomlinson, 2001; Tomlinson & Allan, 2000; Tomlinson & McTighe, 2006; Willis & Mann, 2000). As instructors when we differentiate instruction in the classroom, we are saying that we know students come to us with different backgrounds, preferences and needs. We believe how we respond will make a difference. With the use of electronic technologies, differentiated instruction is beginning to play out in some new forms (Scalise, 2005; Taylor, 2002; Trivantis, 2005; Turker, Görgün, & Conlan, 2006). These include new media inclusion for differentiation, levels of interactivity, response actions, and enhanced ability to collect data on the fly and to deliver custom content (Bennett, Morley, & Quardt, 2000; C. G. Parshall, Spray, Kalohn, & Davey, 2002; C. G. Parshall, Stewart, R., Ritter, J., 1996). Here in cascading we see an example of differentiation of e-learning through peer-to-peer reciprocal leading.

One interesting aspect of differentiated e-learning in general – or e-diff – is how quietly personalization or individualization, one form of differentiation, is slipping into electronic learning products (Hopkins, 2004; Trivantis, 2005). Differentiated instruction through technology is contributing to such diverse purposes as adaptive delivery of content, individualizing learning materials, dynamic feedback, cognitive diagnosis, score reporting and course placement (Gifford, 2001). In cascading, it is applied to a spontaneous format of peer tutoring, through which students adopt rotating roles of leadership and sharing expertise in activities.

Taken all together, the potential of differentiation to affect student learning can be great (Tomlinson & McTighe, 2006). In the e-learning context, it also becomes faster and easier to do for some types of differentiation, so it is important that differentiation is well done, just as is true in the classroom-based context.

3.3.1 Distinctions important for instructional designers to understand

When instruction is differentiated in the classroom, it is often clear that multiple approaches are spiraled into the curriculum. For instance, experiences repeat in different forms or students are grouped and regrouped for course placement and learning activities.

When the differentiation is done entirely within electronic technologies, it can be much less apparent that differentiation is taking place in virtual settings. If one learner is given something different on the computer from some other learner, either locally or at a remote site, it can be hard to tell since the two learners aren't looking at the same screens. Typically there is no basis for comparison. The learner may not even realize that had he or she interacted differently with the computer, it would have interacted differently with them. Also, unless disclosed, we don't necessarily know what e-interfaces are gleaming about a learner or the purposes to which the inferences are being put (Nielsen, 1998).

Furthermore, differentiation in e-learning products can have a different intent from classroom-based approaches. In traditional classroom-based approaches, some researchers argue that the result of differentiated instruction should not be different learning outcomes but rather different ways to access the same learning outcomes (Tomlinson & McTighe, 2006). The argument often is that the strongest classroom-based differentiation ensures all students work with the essential understandings for a segment of learning, thus stabilizing the most substantial learning goals. E-learning products are often designed to stretch the individual student's opportunity to learn. The intent can be to tap areas where interest and engagement are strong, or to give the learner choice among objectives. Cascading can help support all of these goals in some circumstances, where the instructional design may show good fit to student abilities and needs.

3.3.2 What is meant by differentiation in e-learning or virtual settings?

Many teaching approaches that focus on meeting the readiness, interest or learning profile needs of individual students tend to involve one of five types of differentiation, which we briefly review here before continuing with cascading. (Hall, 2002; Reis, et al., 1988; Sizer, 2001; Tomlinson, 2001; Tomlinson & Allan, 2000; Tomlinson & McTighe, 2006; Willis & Mann, 2000).

- Differentiation of content - when students start at different places in the curriculum and/or proceed at different paces.
- Differentiation of process - emphasizing many modalities of learning profiles, including individual learning skills profiles (Boyatzis & Kolb, 1991), learning inventories (Dunn, Dunn, & Price, 1984; Lovelace, 2005), cognitive dimensions (Sternberg, 1997), and multiples intelligences (Gardner, 1999).
- Differentiation of product - different students have different assignments and turn in different products. This is a somewhat controversial type of differentiation, since it may appear to establish different standards for students.
- Differentiation of affect - the feelings and attitudes of the learner may be a differentiation premise in e-learning. This can include choice for preference or confidence building exercises such as dynamic assessment, where hints are provided to the learner until he or she grasps the learning objective.
- Differentiation of learning environment - in the e-learning context this can include individual, small or large group learning; incorporating hybrid instruction that combines elements of technology with offline or classroom-based instruction; distributed learning location; or synchronous and asynchronous learning.

Cascading is a form of reciprocal teaching that can bring about differentiation in all these areas, if desired. It is less commonly used for differentiation of product, where a more a

structured form of reciprocal teaching typically takes place when the role or product is differentiated, such as in the prior examples.

However cascading is one of the tools of e-learning that can most directly contribute to differentiated instruction in the classroom through reciprocal leading. It is one way to answer the question about when we differentiate, how do we decide who gets what? In cascading, rapid short cycles of peer evaluation help to create an active, small-scale differentiation going on as a continuous improvement process in the classroom. It is mentored and monitored through the active more-able-peer role taken on by students, if they have established strong skills in reciprocal leading and can rotate their skills into play to help their learning communities, whether virtual or classroom-based.

3.3.3 A framework of five approaches to differentiation in virtual settings

Before we specifically discuss cascading further, it may be helpful to consider a framework for the most common e-diff strategies in use today (Scalise, 2007a, 2007b). The framework is organized into five general categories, based on what type of decision-making process and evidence is used to establish the adjustment choices. Approaches can also be combined, or blended, in e-learning products. The five general strategies are:

1. “Diffuse” approaches to differentiation, in which students receive the same content but have multiple opportunities for learning and are provided with different approaches for making sense of ideas planfully “diffused” throughout the content.
2. Self-directed approaches, in which students receive different content by a mechanism of self-selection built into the instructional design. This introduces differentiation through student choice.
3. Naive differentiation, in which the computer alone is determining the course of differentiation, not the user, but no specific plan or overall strategy is in place in the e-learning content for why differentiation is happening, or what it is intended to mean in the learning context.
4. Boolean differentiation, in which the software itself does the differentiation as above but uses types of Boolean logic, such as rule-based frameworks or decision trees, to determine how to adjust content for different students.
5. Model-based differentiation, in which expert opinion is combined with a variety of data mining techniques to generate ideas for how content might be appropriately differentiated, with again the differentiation is delivery via some type of computer adaptive process.

Differences in the five strategies are numerous, and here each type is taken up briefly and described.

In *diffuse differentiation*, there is no direct intention to assess or match the needs of individual users, or to customize content or feedback, as all students receive the same content. But enough variety and different sources of stimulation are provided to interest and engage diverse audiences. This is a very common approach to differentiated instruction in a traditional classroom teaching setting. The hope is that with enough variety provided, everyone’s needs can be addressed.

The second strategy, *self differentiation*, allows students to select their personal choices as they work their way through online content. This can consist of simply selecting the order of

completion among a fixed menu of learning activities or modules, or can allow much more range of choice. The courseware design determines where choice points are. Self differentiation is also very common in online content.

Naïve differentiation comes about almost inadvertently in many e-learning products. It involves changing portions of content in a more random way, not based on the specific needs of individual students, but simply rotating content and graphics so that screens have different images, representations and so forth each time viewed. This might involve a randomizing factor or a shuffle function. Though diffuse and self-directed strategies can be quite consistent with improved learning objectives of differentiated instruction, it can be harder to make the case for naïve differentiation. Gains in motivation and engagement as learning displays change, for instance, are hard to argue for if the same student only sees one of the displays.

The next strategy, *Boolean differentiation*, uses assessment evidence to change the flow of content for different students. Boolean here simply describes logic that computers use to determine if a statement is true or false. Main Boolean operators include “and,” “not” and “or.” Operators get used with a series of rules to describe what happens with the content as students make their responses. There are many distinctions among different rule-based methods, including various planning agents, bug bases and chaining algorithms. But the idea is that a set of rules have been devised, often by very carefully studying many students.

These rule-based Boolean methods make up some of the oldest forms of e-diff. The simplest types look like a checklist of learning objectives. Students go down the list and complete the objectives. If they successfully complete 1 AND 2, they go onto 3, for instance. But 1 and NOT 2 and maybe the student is redirected to 2A, or given some additional feedback or other learning intervention that passing students don't get. Rule-based methods can take much more elaborate forms, and have been in very fine-grained ways to describe the multitude of conceptions and misconceptions students hold in certain subject matter areas, and what to do about them. Challenges come in mapping the knowledge space and coming up with effective rules that work, especially for more open-ended and less codified learning objectives, where the permutations of student reasoning quickly grow NP hard to model.

The final form of e-diff to be mentioned here, *model-based*, is actually a large family of approaches that will be grouped together here for the sake of discussion. Some of the approaches are among the newer e-diff forms and others have been around for some time. Most use some form of expert opinion, including from teachers and other subject matter experts, combined with data mining to generate ideas about how content might be differentiated. Common data mining techniques include a variety of regression and Gaussian statistical models, Bayesian networks, neural networks, item response models, and mixed method approaches that combine quantitative and qualitative data to make interpretive or generative predictions.

On the plus side, data mining approaches can be faster and easier than deriving complex rule-based forms. Also they can allow predictions to be compared to actual student learning data to fine tune models. However, the question often is which model to use, and why. Also crucial in the case of e-learning is whether the model really is doing an appropriate job of telling you something about students.

3.3.4 Relationship of cascading to the framework of five approaches to differentiation in virtual settings

Cascading as a form of differentiated instruction draws on the reciprocal leading resource available in the learning environment to help meet the needs of many students. Differentiated instruction though a powerful approach to student learning gains in many settings can suffer from resource issues, and how to get enough expertise applied to the differentiation need. Cascading draws on a continuously refreshing cycle of more-able peer resource in the classroom, with the flow of trading the reciprocal role, just as in reciprocal teaching, allowing everyone to participate both in providing assistance, which can extend student understanding through teaching practices, and receiving assistance, which extends opportunities not only for learning but also for elaboration, extension and reflection.

Working with students to develop their cascading skills for reciprocal roles is important. Developing good reciprocal leading skills here includes understanding the role of the leader, and how to help teams frame their work by asking elucidation questions and encouraging scaffolded reflection. Note too that learners need to see coached examples of how to *receive* reciprocal leading assistance in differentiation. Under the right circumstances, cascading may be able to infuse critical expertise throughout a distributed or virtual site quickly. It is especially useful in situations that would be difficult to take place at all at distributed sites without one or more instructors present, for instance in technology workshops and science laboratories.

Cascading must be used carefully, and students must in advance be shown how to be effective reciprocal leaders in this approach, just as in the more structured approaches described above. It can sometimes result in some students feeling rushed by others who complete tasks and take on reciprocal leading roles, although in our experience this does not happen if specific attention and acceptance of how to provide the rotating assistance and *how to accept the rotating assistance* is introduced when reciprocal leading is taught. It also may be less appropriate in more open-ended problem solving efforts where extensive individual reflection is desired in advance of collaboration, although even here it does allow for cognitive engagement through elaboration and reflection as mentioned. In the right situations and with proper training of the role that reciprocal leaders should play – not doing the work for the other groups but facilitating their problem solving processes – it can be a very effective approach. Virtually, it has been used in both adult learning, where it is very helpful for online and distance settings, and also synchronously face-to-face with even young children, when they are working with e-learning products. It likely is possible to effectively use cascading beyond e-learning settings, but the focus of this article is specifically on instructional designs for e-learning, so we will not take that up here.

4. Conclusion

Distance and hybrid e-learning approaches often call for new ways to facilitate group interaction. Rather than moving away from student centered and group designs, students themselves can be encouraged to take on meaningful reciprocal leadership roles that can expand what can be done at distributed sites, synchronously or asynchronously. By placing students in the role of rotating leaders, they can help facilitate effective small groups for reflection, dialogue and interaction. Such facilitation of multiple groups at a distance in e-

learning is different from the classroom. Structured, semi-structured or unstructured leadership formats can be employed but all call on developing student leadership ability to take on such roles. Critically, students must be able to organize a group to get to a goal. How to divide work, frame discussion and encourage participation are some of the leadership skills that need to be explicitly taught. Good resources for short lessons in this area include *Tools for Teaching* (Davis, 1993) and *Classroom Strategies for Interactive Learning* (Buehl, 2001).

When students lead, they must know how to rephrase and reframe when they meet challenges in advancing the progress of their group. Experienced instructional leaders know what to do when their efforts are met with blank looks: for instance, come at it again from another direction.

Reciprocal leaders who are unfamiliar with taking charge can readily lapse from the leadership role. They may even be startled when the group stalls and they are reminded to stay on task. As the course instructor, it might be tempting to step in and take charge for the leader. However, a more effective strategy would be to remind the leader of the role and let him/her make attempts to move forward. Encourage the leader to consult the group for help if they don't know what to do.

School culture and school climate can help in the degree to which students can lead successfully. Supportive environments where students feel free to take on more risk in their group roles are important. When efforts to stretch are themselves valued as a form of success, this is especially helpful. A culture of inquiry and exploration is empowering and helps to propagate leadership through a bootstrapping process of sharing new knowledge.

How the course instructor facilitates success is also very important. Communication efforts are key. Students need to know the leadership roles they are expected to take and have information on how they can be accomplished. Even if the role is to be unstructured like cascading, this needs to be made clear so students know when they are in the position of becoming reciprocal leaders. Communication of expectations reduces anxiety about assuming leadership in learning settings, where by definition students are not yet fully proficient.

Students who are reciprocal leaders will likely have fragmented knowledge in the topic area. Even in the context of reciprocal leadership, course instructors need to make the transitions from topic to topic clear and to organize the relationships sufficiently for students to make the conceptual connections among big ideas clear. Something as simple as a class agenda for each session helps students know and anticipate what is going on, and can help students make the conceptual ties between class activities and the learning objectives. Instructors must also be prepared to step into the reciprocal leading process at the appropriate places, so that students are well guided as they negotiate new territory.

Finally, instructors should be aware of their assumptions. While scaffolding of the reciprocal leadership role always needs to be addressed, this may be especially important when students are coming to reciprocal leadership with a different epistemology or set of ontological relationships than is common for the methodology, discourse language and other tool sets for the subject or grade-level area. Instructors can help students to connect the thinking of the new field with their prior knowledge as they engage in leadership activities.

Leadership thus becomes a joining of the old with the emerging knowledge of the new, to benefit the whole.

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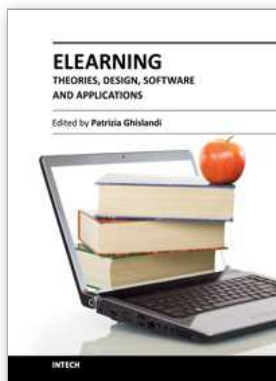
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The term was coined when electronics, with the personal computer, was very popular and internet was still at its dawn. It is a very successful term, by now firmly in schools, universities, and SMEs education and training. Just to give an example 3.5 millions of students were engaged in some online courses in higher education institutions in 2006 in the USA¹. eLearning today refers to the use of the network technologies to design, deliver, select, manage and broaden learning and the possibilities made available by internet to offer to the users synchronous and asynchronous learning, so that they can access the courses content anytime and wherever there is an internet connection.

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