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How Media Ecologies Can Address Diverse Student Needs

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One of the most significant trends in education today is the exploration of new media for teaching and learning. We see more and more the use of podcasts, blogs (Ganley 2007), wikis, interactive websites, online discussion forums, writing with video, conferencing tools, personal response devices (D'Arcy et al. 2007), online quizzes/surveys, and presentation software. These exist alongside traditional media (or formats¹) such as lectures, textbooks, and paper handouts. The growing variety of media raises questions such as: Do the new media make a difference? For whom? How do they compare with traditional media? And, do the benefits outweigh the costs?

The use of a variety of instructional media intersects with a second major trend, the increasing diversity among learners. In higher education, this diversity arises both from the enlarged opportunities for students who previously were denied the chance at tertiary study, as well as from the way that disciplines have opened up to students from different gender, racial, ethnic, class, and linguistic groups. Do these non-traditional students benefit from particular media more than others? If the new media make a difference, do they do so differentially for students with different backgrounds or learning styles? How well do any students take advantage of the array of possibilities offered by the new media?

General education courses define both a need and an opportunity to address these questions. Two of us (CJD, DME) teach one such course, Plant Pathology 200 - *Plants, Pathogens, and People* (PLPA 200), which provides opportunities to study both diverse students and a variety of media. The course uses current and historical plant disease epidemics to introduce students to concepts in plant pathology and to issues in agriculture. Students learn how plant pathogens affect their food, their clothing, the economy, the environment around them, the

history of human enterprises and migrations, and many other aspects they may never have considered before. The course fosters *integrative learning*, in which students develop the ability to integrate across disciplines, and between academic, personal, and community life (Huber et al. 2007). The integrative approach appeals to diverse students - sophomores, juniors, and seniors from six or more different colleges in the university. They come also because the course fulfills general education requirements in both natural science and advanced composition. Thus the students in PLPA 200 represent a variety of backgrounds, interests, and motivations.

In an attempt to address the students' diversity in learning styles, gender, and major, we present material using multiple instructional formats and several different types of media. Thus, the course has both a diverse range of students and a rich assortment of media. This diversity leads to the question: How do students of all learning styles and majors, and of both genders, perceive the learning opportunities afforded by different media?

One finding from our study is that all students perceive some of the same instructional media as useful. These "successful" methods include examples with a long history and examples that are relatively new. We also found more similarities than differences across groups; there was no simple mapping from learner type to media type. Finally, all students valued a mix of media; this was especially so for females and non-science majors. We conclude that a rich ecology of media appears to work best, not simply one approach or two. Moreover, it is necessary to look closely at how a medium is used, because simple characterizations, such as "lecture" or "website" may obscure what the media really mean for students. These findings are important to consider in any discussion, use, or study of learning styles and instructional media.

Background

Instructional Media

We have used 19 different instructional media for instruction in PLPA 200 from Fall 2003 through Fall 2005 (see Figure 1). We group these into visual aids, web-based tools, face-to-face formats, and paper-based tools. Although this set is by no means exhaustive, it does include a wide variety of media, which have the potential to serve the needs of diverse learners.

Fourteen of these media were used every semester: lecture, handouts, chalkboard, videotapes, small group discussion, whole class discussion, in class writing, outside of class writing, a textbook, a supplemental web site (www.ppp.uiuc.edu; Bruce, et al. 2005) with text, images, and interactive exercises, and quizzes and PowerPoint notes that were accessed on line. Two visual aids were used only by CJD (overheads, color slides) and one only by DME (PowerPoint slides). In addition, two instructional media were introduced during the course of the study. Review grids are charts that challenge students to recall and organize information learned in different class sessions; i>clickers are personal response devices that allow students to participate anonymously in class sessions by answering multiple choice questions (www.iclicker.com; D'Arcy et al. 2007).

Diversity of Learners

As noted above, students in the course represented different majors, even schools or colleges within the university, different educational levels, and genders. There were many other characteristics that might impact their learning preferences, but our experience suggested that gender and major might be the most significant. In addition, we wanted to consider individual learning styles.

Many models and instruments have been proposed to categorize people by their learning

style (e.g., Felder and Silverman 1988; Gregorc 1982; Herrmann 1990; Kolb 1984; Lawrence 1994; Witkin et al. 1971). The field has been criticized as well, as having neither a consistent theoretical foundation, nor sufficient empirical support (Coffield et al. 2004). Without taking sides in these controversies, we felt that a learning style inventory might provide one useful lens on student differences with respect to the new media used in the course.

We selected the Gregorc Style Delineator (Gregorc 2007) based on his use (1982) of the instrument with adolescent and adult learners, and because it is a self assessment that can be completed in less than 15 minutes. This instrument has been used previously to assess post-secondary students' preferences for different instructional strategies (e.g., Miller 2005; Schmidt and Javenkoski 2000; Seidel and England 1999).

The Gregorc inventory identifies preferred, neutral, and nonpreferred learning styles by determining how an individual perceives and organizes information. Gregorc defines the concrete (C) perceptual ability as that which enables the learner to register information directly through the five senses, while the abstract (A) ability allows the learner to visualize and to conceive ideas using intuition and imagination. The sequential (S) ordering ability allows the learner organize information in a step-by-step linear manner, while the random (R) ability facilitates organization of information in blocks in no particular order. Perceptual and ordering abilities are paired to create four learning styles - AR, AS, CR, CS - as shown in Figure 2. Gregorc contends that everyone uses all four of these learning styles, although in varying proportions.

Materials and Methods

PLPA 200 was taught by one instructor (DME) during Fall 2003, Spring 2004, and Spring 2005. Another instructor (CJD) taught the course Fall 2004 and Fall 2005. For these five semesters, students voluntarily completed the Gregorc Style Delineator near the beginning of the

semester and a survey on preferred media for learning near the end of the semester. Students who scored ≥ 26 in a Gregorc learning style were judged to prefer that style. A single student could prefer one, two, or even three learning styles.

The end-of-semester survey (Appendix 1) assessed students' perception of the effectiveness the different media used for instruction. The rating scale was from 1 (totally ineffective) to 5 (highly effective). We grouped students by preferred learning style, by gender and by major (science vs. non-science) for analyses. Science majors included students in agricultural sciences and engineering sciences, as well as those majoring in basic sciences such as biology, chemistry, and physics. We did not group students by race or ethnicity because low numbers in some of these groups would have compromised student anonymity. For the frequency analyses, ratings of 1 and 2 were classified as ineffective, 3 was neutral, and 4 and 5 were effective. We classified a medium as effective when a strong majority ($\geq 2/3$) of the participants in a learning style group rated it effective (a 4 or 5).

Correlation and multiple regression analyses were conducted using the Proc CORR and Proc GLM programs of SAS (Cary, NC), with individual student scores of each of the four learning style categories and the 1 to 5 ratings of the instructional media. The four learning style scores, gender, and major were used as independent variables in the regression analyses, and the 1 to 5 rating scores were used as the dependent variable. The learning styles scores also were used to categorize students into groups (preferred, acceptable, and non-preferred) within each of the learning styles categories (AR, AS, CR, CS). These group placements were then used as independent variables in analyses of variance, using the ratings of the various methods and media as the dependent variables.

In order to explore *why* students found particular instructional media particularly effective or ineffective, graduate research assistants conducted focus groups of three to seven

volunteers with a total of twenty-five students. Students responded to a series of questions about the media used and their responses were audio-recorded and transcribed. Comments were coded by medium, and grouped by learning style and by instructor, so that recurring themes within and across groups could be identified.

Results

In this section, we report results of the frequency analysis - evaluations of the various media by students categorized according to learning styles, the correlation/regression analysis - comparing student scores with their evaluations of the instructional methods, and focus groups - student opinions regarding which media were most effective and why the particular approaches or media helped them to learn.

Frequency Analyses

Learning Styles. Over five semesters, the preferred learning styles of the 272 students who participated in the study were 78 AR, 95 AS, 99 CR, and 169 CS (some students preferred more than one style). When summed across the entire study, the four learning style groups each perceived a similar number of the available instructional media to be useful (41.7% for AS and CR, 43.1% for CS, 50.0% for AR). However, when analyzed by semester, the percentage of media perceived as effective increased over time, beginning with 18.3% in Fall 2003 and reaching 52.8% in Fall 2005. The results for both instructors showed an increase in perceived effectiveness every semester, which means that the instructors learned how to use the various media more effectively.

Of the 19 media, 14 were perceived as effective by at least one learning style group in at least one semester (Table 1): lecture, handouts, chalkboard notes, overheads, PowerPoint slides, color slides, videotapes, whole class discussion, i>clicker, review grids, outside class writing,

PPP web site images, on-line quizzes, and PowerPoint notes. The remaining media were perceived as neutral, with the exception of the textbook, which was rated ineffective one semester by AR and one semester by CR students.

Eight media were perceived as effective by each of the four learning style groups in two or more semesters: lecture, chalkboard notes, overheads, PowerPoint slides, i>clicker, review grids, on-line quizzes, and PowerPoint notes. We consider these media to be ones that “cut across” Gregorc’s learning styles, and are useful for many of the students in a diverse class.

Four instructional media were most often rated effective by the students. The primary, in-class visual aid of each instructor - overheads for CJD and PowerPoint slides for DME - were rated effective by students of all learning styles every semester with one exception. In addition, the two instructional media that were introduced by the instructors during the course of the study (i>clickers, review grids) were rated highly effective by students in all four learning styles across all three semesters.

A few differences in preferences for instructional media were noted across the four learning styles. Writing assignments completed outside of class and whole class discussion were never viewed as effective by CR students, while AR students never reported learning from the images on the supplemental course web site. Each of these media was rated effective by the other three learning styles groups at least once. Also, only random learners ever selected videotapes as an effective learning medium.

Two instructional media used by both instructors, the chalkboard and the PowerPoint notes, were more often rated effective with one instructor than with the other. One instructor (CJD) utilizes overheads and the chalkboard as primary visual aids during class; the other instructor (DME) utilizes PowerPoint slides. Copies of DME’s slides (called PowerPoint notes) were available on the class website all five semesters. The chalkboard was consistently rated

effective by CJD's students and only once by DME's, while the PowerPoint notes were consistently rated effective by DME's students and only once by CJD's.

Gender and Major. There were 120 female and 152 male participants in this study (Table 2). Of these, 113 participants were science majors and 149 were non-science majors. It was not possible to determine the major of ten students who left the university during the course of the study.

The same eight media rated as useful across learning styles were perceived as useful regardless of students' gender or science background (Table 2). However, female and non-science students found more media effective than did male and science students. The differences in the frequency analyses for these two variables follow similar patterns because 70% of the female students were non-science majors, whereas male students were fairly equally divided (53% science and 47% non-science). Female and non-science students more often found videotapes, whole class discussions, out-of-class writing assignments, and the supplemental class PPP web site more effective for learning than did males and science majors. Each of these media provides students the opportunity to glean additional information from external sources (electronic, paper, or human), opportunities that are more likely to be valuable for students with less scientific background.

The textbook was perceived to be ineffective by female students one semester, by non-science majors two semesters, and by science majors three semesters. The textbook was probably perceived as ineffective by many students because it was used only as a supplement to the lectures. Students could succeed in the class without reading the textbook. This is one of many examples in which we saw that the context of use shaped the interpretation of the media, a fact that argues against generalizing ratings to other contexts. The value of a particular medium depends on its place in the whole learning ecology.

Correlation and Regression Analyses

While the frequency analysis concentrated on evaluations of the various media by students who preferred a particular learning style (score ≥ 26), the correlation and regression analyses included the complete continuum of student scores (possible score range 10-40) in each of the four learning style categories. Individual scores for the four learning style categories (AR, AS, CR, and CS) for each student were used to determine if associations existed between the scores for specific learning style categories and instructional media preferences. The correlation analysis showed that student scores in the CS category were positively correlated ($r = 0.17$, $p = 0.052$) with scores in the AS category but negatively correlated with scores in the AR and CR categories ($r = -0.46$ and -0.65 respectively, $p < 0.001$). This showed that the segregation of the students along the sequential-random continuum was more pronounced than the segregation along the concrete-abstract continuum.

Correlation and regression analyses showed that student CS scores were positively associated ($r = 0.17$, $p = 0.0054$) with ratings of handouts and with ratings of PowerPoint notes ($r = 0.10$, $p = 0.085$). Analysis of variance using the "preferred", "acceptable", and "non-preferred" groupings within each of the learning styles categories also showed a significant association ($Pr > F 0.0135$) of handout rating with grouping within the CS learning style category in an analysis of variance. The students in the CS-preferred category rated handouts the highest (3.6 on a 1 to 5 scale), while the CS-acceptable and CS-non-preferred students rated handouts somewhat lower (3.3 and 2.5 respectively). However, only two students fell into the CS-non-preferred group, and there was no significant difference between the CS-preferred and CS-acceptable groups in an LSD mean separation analysis. These findings are consistent with Gregorc's description of the characteristics associated with the CS learning style. Individuals with a high CS score prefer structure and an identifiable sequence to follow for learning.

AS scores showed a slight negative association with ratings of chalkboard use ($r = -0.10$, $P = 0.096$) and small group discussion ($r = -0.12$, $p = 0.056$), while CR scores were negatively correlated ($r = -0.11$, $p = 0.064$) with ratings of handouts. No other associations between learning style scores and media rating scores were statistically significant in both correlation and regression analyses.

Focus Groups

In the focus groups, students shared their opinions as to what media were most effective and, more importantly, explained *why* particular approaches or media helped them to learn. We analyzed student responses in terms of themes that emerged from repeated readings. The themes we found for seven of the eight media that were reported to be effective across learning styles, genders, and majors are discussed. There were insufficient comments on the use of the chalkboard for analysis.

Lecture. The central theme that emerged from student focus groups was that lecture was effective because it was not a traditional “sage on the stage” presentation, but rather incorporated periods of interaction between students and between the instructor and students:

I would have to say that this didn't feel like a lecture class... You could definitely raise your hand and ask questions. (AR-CS)

... they will break (it) up and like ask questions in between, like do an activity and then come back to it to keep people like more engaged. (AR-CS)

...she would get involvement and she wouldn't move on until she got involvement... (AR-CR)

Overheads. The key effective component of overheads mentioned by students was their

clarity. Overheads were particularly effective when charts or diagrams (as opposed to text) was presented, and they allowed the instructor to easily highlight important information:

Yeah, the images were the main, uh, bright spot for the overheads... you can't do some of this stuff by hand (AS-CS)

She would just put up an overhead and point to it, and it would be much easier to have a conversation about what she was talking about. (AS-CS)

PowerPoint Slides. Images were also highlighted by students as an important component of PowerPoint slides:

Pictures are also nice, yeah, just because it kind of gives you a break in between more information coming at you. It's just kind of like, like, now you can visualize it. (CR)

but students also noted that this medium helps the instructor to convey information in an organized manner that is easy to follow:

It's easier to follow exactly what they are saying... It keeps everything real organized and it is just easier to understand. (AR-CS)

He grouped the important information together. (CS)

i>clicker. Five themes emerged in student discussions of the use of student response devices during class periods. First, these devices were an active learning medium:

If you were not paying attention, it was a way to come back and get involved again. You have to think about this. (AR-CS)

Yeah, whenever he's like, "answer the question", you know, you'd

perk up. (CS)

If you had the i>clicker, you'd be like "Okay, I gotta choose one of these" like "I want to get it right." It forced you to be more active... (AS)

Students also commented that the i>clickers allowed them to test their knowledge, before, during, and after the discussion of a particular topic:

She would ... start out the new subject (and) would ask like what we knew about it, and that's kind of cool because we saw that like, you know, we didn't know anything about it clearly, and have something like valuable to learn about it. (CS)

I liked when she did the, used the "C" for when you were confused, so that way she'd go back and that way you didn't have to raise your hand... (CS)

It was a good way to test your knowledge without getting graded on it. You would get immediate results. (AS-CS)

The fact that student participation was anonymous, alluded to above, was another reason students gave for the effectiveness of this learning medium:

It's a good way to participate in class without actually having to say anything. (AR-CS)

It's not like you're raising your hand, so you don't feel stupid and all. (AR-CS)

... it was anonymous so you didn't feel bad if you got it wrong. (AS-CS)

Students also recognized and appreciated the fact that i>clicker questions provided immediate feedback to the instructor, so that she or he could make adjustments mid-stream:

...if there's a question that like only less than half the class got that it's something that we don't really understand, so he should discuss it a little bit more. (CS)

When the professor turns around and asks if there are any questions, like, no one is going to ever ask a question. So this is kind of a good way to find out if there really are. (CR)

And, finally, students said that i>clickers were an effective medium for learning simply because they were fun.

I really liked the i>clicker. It was just kind of cool, to keep your interest. (AS-CS)

I thought they were really fun... and it was nice to kind of see where you are with the rest of the class. (CR)

Review Grids. Students reported that review grids were an effective learning medium because they provided a means to organize a lot of information, making it easier to study and master:

I like them because there was a lot of information to know, like a lot of facts, and they could be fit into the same categories so it worked well to memorize. (AR-CS)

It kind of organizes and matches up. It is easier to see. It is easier to remember. (AS-CS)

Online Quizzes. Three themes emerged from student comments about the weekly online

quizzes. First, they encouraged students to keep up with the material:

...if you have to take a quiz every week, you are going to have to keep on top of the material. It is easy to like procrastinate and wait until the exam. (AR-CS)

(The) most important thing, which I think every college student should do but I've never done, is look at your lecture notes right after your taken them and (the quizzes) make you do that. (CR)

In addition, the quizzes helped the students focus on what is most important for them to learn:

I think it was helpful because it was like what you had just learned that week, and the teacher was trying to show you what was important and what you should learn... (AR-CS)

It was helpful to understand or see what the teacher wanted me to know. (AS-CR)

And, finally, quizzes were effective for learning because the students received timely feedback:

I like how we could answer the question again when she went over the review the next day, so it was like you could see if you learned yourself from what you just did, and then you could ask her questions, too, like why you were wrong. (AR-CS)

She went over them and gave the answers... and she would explain it to you so you knew the material better. (AR-CS)

PowerPoint Notes Online. Having access to PowerPoint notes online that could be

printed and brought to class was effective because it allowed students to write less and listen more during the class period:

It alleviates the need to scribble down everything. You can focus on listening and following what is going on... (AR-CS)

If he was talking about a lot of stuff and I am trying to get down what he was saying instead of what is on the PowerPoint, I know I could always go back and get what was on the PowerPoint. (AR-CR)

Discussion

The student comments in the focus groups cause us to question the simple taxonomy of media shown in Figure 1. For example, one student said about overheads, "She would just put up an overhead and point to it, and it would be much easier to have a conversation about what she was talking about." Is the overhead just a medium for conveying content, or is it better conceived as a stimulus for conversation? Another student said about PowerPoint slides, "You can focus on listening and following what is going on..." (because it's possible to go back to the slide after class). Throughout the focus group comments we see references to the rhythm of learning, the need for variety, and the complex interplay of in-class and out-of-class activities. What do we mean by "lecture," if as one student said, "I would have to say that this didn't feel like a lecture class"? This suggests the need for a relational conception of instructional media, one which situates them in the context of other media, the learning context, the learning tasks, as the characteristics of the teacher and learners (Haythornthwaite et al. submitted).

We found that some of the instructional media were perceived as useful by students of all learning styles, majors, and genders. It is important to note that these are the students'

perceptions of the usefulness of different media, and not independent measures of student use or effects on their learning. It is possible that there are differences between what students believe aids their learning and what actually does. Regardless, we found that there was no simple mapping from learner type to media type. Eight instructional media were perceived as effective by each of the four learning style groups, by both genders, and by science and non-science majors in two or more semesters: lecture, chalkboard notes, overheads, PowerPoint slides, i>clicker, review grids, on-line quizzes, and PowerPoint notes. Thus, these media may be generally useful for diverse students. The reasons for the success of these media vary, but the fact that they are generally perceived as useful is encouraging from a practical perspective. However, their success should not be interpreted in a technocentric way. Instead, their usefulness reflects an interaction of the context of learning, the learning tasks, the teaching styles of the instructors, and this particular set of general education students. The findings thus support the idea of the reciprocal nature of instructional communications, the instructional setting, and the learner (Salomon 1981), and show a way beyond the idea that each medium is capable of conveying content only via its inherent symbol system (Salomon 1979). What we can say is that diverse media are valued by students and likely to contribute to greater learning.

Female students and non-science students (highly correlated in this setting) generally found more media useful than male, science students. The students with less scientific knowledge found some media to be useful that the stronger science students deemed neutral for learning. Overall though, the preference for multiple media by all students provides additional evidence for the idea that multiple representations of content are necessary for learning, especially in complex, or ill-structured domains (Spiro et al. 1988); the whole is greater than the sum of the parts.

There is much debate about the validity of particular learning styles models and the

usefulness of the associated instruments. However, our experience with the Gregorc Style Delineator indicates that it does separate students into diverse groups and that the participants generally agree with Gregorc's descriptions of them as learners. In addition, all teachers probably agree with Sarasin when she writes, "...whatever systems and labels might be proposed, students have individual learning needs, learn in different ways, and process information differently. For these reasons, postsecondary instructors need to give attention to learning styles." (Sarasin 1999, p. 36)

Conclusion

Our findings are important to consider in any discussion of learning styles and new media. They challenge views held by some that particular media are uniformly superior to others, or that particular students can learn in only one way. They also suggest avenues for further exploration by teachers and researchers.

Overall, our findings take us away from a quest for the ideal instructional medium, or the notion that some specific media are best for particular students. It is true that there are differences according to student learning style or instructor teaching style, but the overriding message is the need to consider the entire learning ecology (Cross 2007; Bruce 2008 in press; Bruce and Hogan 1998; Nardi and O'Day 1999). We need to think about the histories of learners, how technologies serve in relation to changing learning needs, and how diverse resources can be used in a concerted way. None of this offers easy answers, but rather demands the need for continual inquiry in teaching and learning.

One take-home message for instructors as they experiment with a variety of instructional media is not only to determine *what* is successful, but to determine *why* it is successful. This examination may lead to the redesign of particular tools so that more students are able to learn from them, or to the abandonment of a particular tool that is only serving the needs of a minority

of the students. For example, we changed the textbook in our course from “required” to “recommended” when it became clear that only a few students found it an effective learning aid. Reflective teaching demands critical inquiry into why we do what we do, and a spirit of experimentation in order to provide opportunities for all students to succeed.

Notes

It might be useful to explore the various meanings, examples, and complexities of "media," "format," "tool," "application," "approach," "technology," and similar terms. For example, are overheads and PowerPoint slides different media? For the instructor the difference may be significant; for a student, they may simply represent equivalent ways of seeing information on a screen. Each offers its own affordances and constraints, but these may or may not come into play in a particular learning setting. For this paper we generally use "media" to refer to specific, identifiable pedagogical devices, without making sharp distinctions as to category.

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Table 1. Number of semesters/total semesters tested that a format/medium was rated as effective (rather than neutral or ineffective) by $\geq 2/3$ of the students in each learning style group.

Format/Media	AR n=78	AS n=95	CR n=99	CS n=169
Lecture	4/5	3/5	4/5	4/5
handouts	2/5	1/5	1/5	2/5
chalkboard	2/5	2/5	3/5	2/5
overheads ¹	2/2	2/2	2/2	2/2
PowerPoint slides ²	3/3	2/3	3/3	3/3
color slides ¹	2/2	1/2	1/2	1/2
videotapes	1/5	0/5	2/5	0/5
small group discussion	0/5	0/5	0/5	0/5
whole class discussion	1/5	2/5	0/5	1/5
i>clicker ³	3/3	3/3	2/3	3/3
Review grids ³	3/3	3/3	3/3	3/3
in class writing	0/5	0/5	0/5	0/5
Outside of class writing	4/5	3/5	0/5	2/5
textbook	0/5	0/5	0/5	0/5
PPP ⁴ text	0/5	0/5	0/5	0/5
PPP images	0/5	1/5	1/5	1/5
PPP interactive exercises	0/5	0/5	0/5	0/5
on-line quizzes	5/5	4/5	5/5	4/5
PowerPoint notes	4/5	3/5	3/5	3/5

¹used two semesters by one instructor (CJD)

²used three semesters by one instructor (DME)

³ introduced Fall 2004

⁴*Plants, Pathogens, and People* web site: www.ppp.uiuc.edu

Table 2. Number of semesters/total semesters tested that a format/medium was rated as effective (rather than neutral or ineffective) by $\geq 2/3$ of female or male students and science or non-science majors.

Format/Media	female n=120	male n=152	science n=113	non-science n=149
lecture	4/5	3/5	4/5	4/5
handouts	2/5	1/5	1/5	1/5
chalkboard	2/5	3/5	2/5	2/5
overheads ¹	2/2	2/2	2/2	2/2
PowerPoint slides ²	2/3	3/3	3/3	3/3
color slides ¹	2/2	1/2	2/2	1/2
videotapes	1/5	0/5	0/5	1/5
small group discussion	0/5	0/5	0/5	0/5
whole class discussion	2/5	0/5	0/5	1/5
i>clicker ³	3/3	3/3	3/3	3/3
review grids ³	3/3	3/3	3/3	3/3
in class writing	0/5	0/5	0/5	0/5
outside of class writing	3/5	1/5	1/5	3/5
textbook	0/5	0/5	0/5	0/5
PPP ⁴ text	0/5	0/5	0/5	1/5
PPP images	1/5	0/5	0/5	1/5
PPP interactive exercises	0/5	0/5	0/5	1/5
on-line quizzes	5/5	4/5	4/5	5/5
PowerPoint notes	4/5	3/5	4/5	3/5

¹used two semesters by one instructor (CJD)

²used three semesters by one instructor (DME)

³ introduced Fall 2004

⁴*Plants, Pathogens, and People* web site: www.ppp.uiuc.edu

Figure 1. Instructional media used in Plant Pathology 200 - *Plants, Pathogens, and People*.

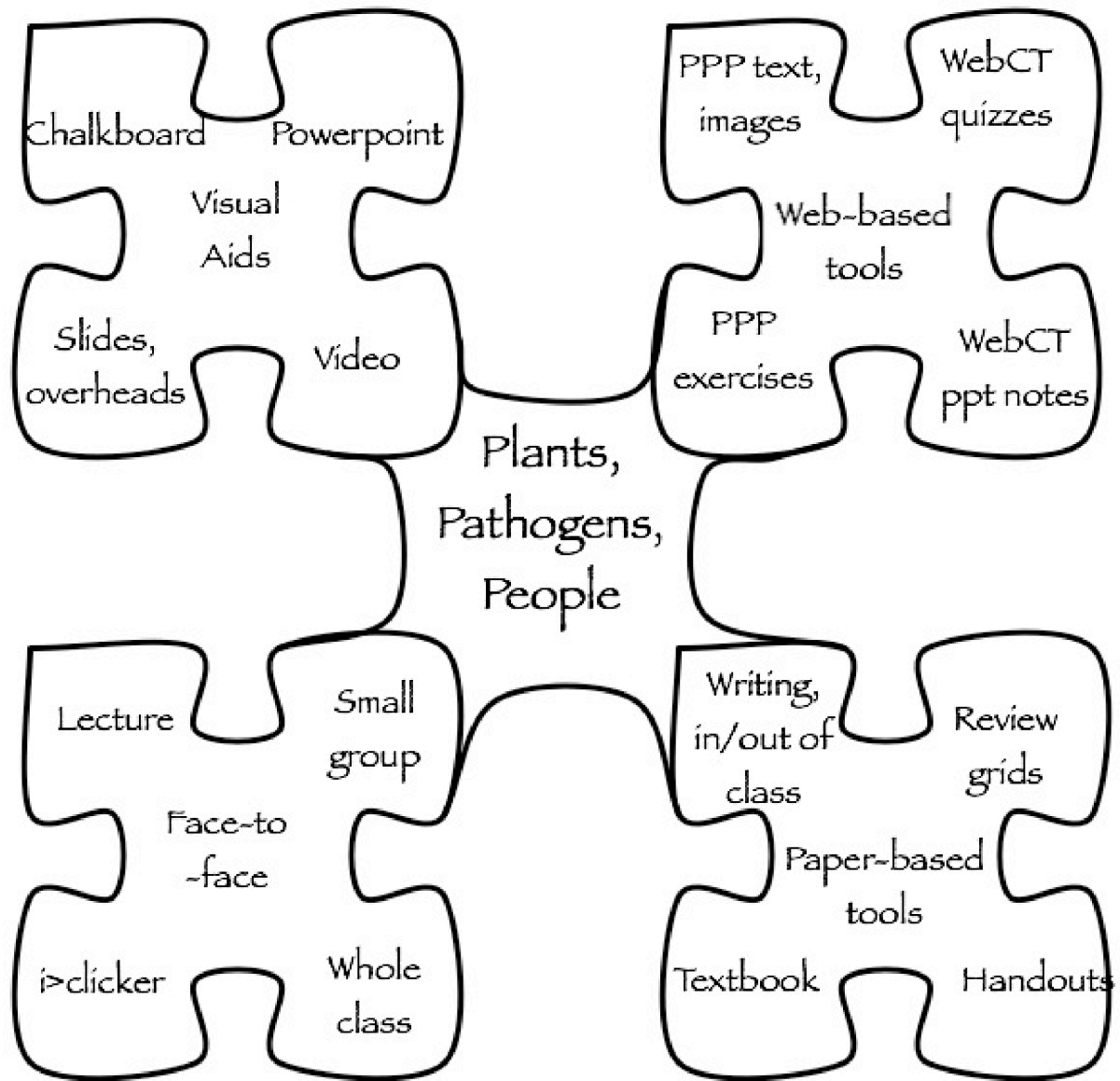


Figure 2. Gregorc learning styles.

		Perceptual Ability	
		Abstract	Concrete
Ordering Ability	Random	Abstract Random (AR)	Concrete Random (CR)
	Sequential	Abstract Sequential (AS)	Concrete Sequential (CS)

Appendix 1. *Plants, Pathogens, and People* instructional media survey.

Plant Pathology 200

Instructional Format and Media Survey

During this semester you have learned about plant diseases and their effects on people through a variety of instructional formats and media. This survey is designed to find out which of the methods are most effective media for student learning. Please indicate how effective each format or media was *for you* by filling in the circle under one of the numbers on the continuous scale from 1=totally ineffective (you learned nothing from this) to 5=highly effective (you learned a great deal from this).

format/media	1	2	3	4	5
	totally ineffective				highly effective
lecture	o	o	o	o	o
handouts	o	o	o	o	o
visual aids					
chalkboard notes	o	o	o	o	o
Powerpoint slides	o	o	o	o	o
overheads	o	o	o	o	o
color 2x2 slides	o	o	o	o	o
videotapes	o	o	o	o	o
discussion					
small group	o	o	o	o	o
whole class	o	o	o	o	o
i>clicker	o	o	o	o	o
review grids	o	o	o	o	o
writing					
in class	o	o	o	o	o
out of class	o	o	o	o	o
textbook	o	o	o	o	o
PPP web site					
text	o	o	o	o	o
images	o	o	o	o	o
interactive exercises	o	o	o	o	o
WebCT site					
on-line quizzes	o	o	o	o	o
Powerpoint notes	o	o	o	o	o

Thank you for completing this survey. Your results will help us in our continual efforts to improve Plant Pathology 200.

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