Abstract: This white paper describes research-based findings for optimizing the delivery of distributed distance learning using multiple tools. The paper combines research from the areas of modern portfolio theory, multiple intelligences, and distributed learning to form a theoretic approach to allocating classes of tools in optimized percentages to create the best delivery models for distributed learning. Classes identified by research included: face-to-face interaction, synchronous interaction, asynchronous interaction, and interaction with web-based content. Research conducted for the paper revealed that certain classes worked best with specific strategies. The paper does not make claims that these are the only classes, or even the best ones, but lays the foundation in a white paper for an expanded, theoretic definition of distributed learning and how delivery models can be optimized.

Introduction

Markowitz laid the groundwork for Modern Portfolio Theory (MPT) in the 1950s. His paper, Portfolio Selections (as cited in Armstrong 2002), demonstrated that risk could be measured not only at the individual security level, but also at the level of the portfolio (Armstrong 2002). According to Armstrong, by measuring risk at the portfolio level, analysts can understand the relationship of various ‘asset classes’ of securities, how these ‘asset classes’ interact with each other, and thus make informed choices about how to diversify a portfolio to optimize a realistic and level rate of return over time. That is, MPT indicated it was more important to diversify securities in ‘asset classes’ that provided a measurable rate of return over time than it was to predict how an individual security might specifically add value within a portfolio. These classes tended to have inverse relationships with each other, such as stocks vs. bonds, so that, over time, when one class was losing another class was gaining return. In this fashion, a steady rate of return could be predicted without having to ‘guess’ which particular ‘asset class’ would provide the greatest rate of return at any one time.

Modern Portfolio Theory revolutionized investing for the typical investor (Armstrong 2002). No longer did individual investors have to rely on esoteric predictions by commissioned stockbrokers. Individual investors could make money simply by diversifying a portfolio and spreading risk. As long as investors maintained a steady flow of capital into identified ‘asset classes’ in specific percentages, these investors could more or less be guaranteed a measurable rate of return over time. Investors could spread their own risk within MPT by customizing the percentage allocated to each asset class. For risk-adverse investors, higher percentages of investment would be allocated into classes with less risk. Over time, this might mean less return but less risk would be involved. Similarly, investors willing to take on more risk could allocate investments with a higher percentage of capital in classes with more risk but perhaps gaining a greater overall return.

The purpose of this white paper is to posit how lessons learned from Markowitz and MPT can provide a theoretic basis for designing delivery models for distributed learning. By allocating tools by percentage based on an understanding of what classes of tools work best with what strategies and learners, delivery models can be designed that optimize the learning environment for all learners and not simply the most self-motivated ones. This paper will connect the asset class approach of Modern Portfolio Theory to logical classes of distributed learning delivery and online teaching strategies.
Multiple Intelligences and Online Teaching Strategies

Howard Gardner provided an unique and useful way for looking at how students learn, and, more importantly, for designing classrooms that take into account the multiple ways in which students learn (Gardner 1993). Originally conceived in 1983, Gardner currently has nine identified intelligences:

1. **Linguistic Intelligence**: the capacity to use language to express what’s [sic] on your mind and to understand other people.
2. **Logical/Mathematical Intelligence**: the capacity to understand the underlying principles of some kind of causal system, the way a scientist or a logician does; or to manipulate numbers, quantities, and operations, the way a mathematician does.
3. **Musical Rhythmic Intelligence**: the capacity to think in music; to be able to hear patterns, recognize them, and perhaps manipulate them.
4. **Bodily/Kinesthetic Intelligence**: the capacity to use your whole body or parts of your body (your hands, your fingers, your arms) to solve a problem, make something, or put on some kind of production.
5. **Spatial Intelligence**: the ability to represent the spatial world internally in your mind.
6. **Naturalist Intelligence**: the ability to discriminate among living things (plants, animals) and sensitivity to other features of the natural world (clouds, rock configurations).
7. **Intrapersonal Intelligence**: having an understanding of yourself; knowing who you are, what you can do, what you want to do, how you react to things, which things to avoid, and which things to gravitate toward.
8. **Interpersonal Intelligence**: the ability to understand other people.
9. **Existential Intelligence**: the ability and proclivity to pose (and ponder) questions about life, death, and ultimate realities. (Adapted from PBS 2004 para 3 - 11)

Gardner’s Theory of Multiple Intelligences is generally accepted to be a sound method by which instructors can design curriculum customized for the learning capacities of many students. For example, an instructor might modify a traditional lecture-based approach to teaching a skill by including opportunities for learning through collaboration, deepening learning through reflection, and/or using graphics and multimedia. In this fashion, a broad range of student intelligences can be addressed assuring more students would be able to learn the material than just those with a high degree of Linguistic or Logical Intelligence as typified in traditional educational settings.

Similar to Multiple Intelligences, Menchaca (2002), by conducting an evaluation of an online Master’s degree in Educational Technology, discovered that students were most successful learning online when exposed to a broad range of technologies and teaching strategies. Menchaca related that students were not skilled in all tools, but by operating within a system utilizing multiple tools, students would have a greater degree of success finding those tools with which they were most comfortable learning. The evaluation identified four major categories of tool usage: face-to-face interaction (traditional class, community-building retreats, advising); synchronous interaction (chat rooms, phone conferences); asynchronous interaction (discussion forum, electronic mail, collaborative software); and interaction with web-based content (web sites, PDFs, multimedia). In many ways, the tools with which students learned best addressed their multiple intelligences. The study noted that students’ who liked using the chat software (synchronous) did not always like the discussion forum (asynchronous) and vice versa. Relating to the Theory of Multiple Intelligence, this would make sense given that predominantly synchronous learners likely possess a high degree of Intrapersonal Intelligence while predominantly asynchronous learners likely possess a high degree of Intrapersonal Intelligence. Using an Empowerment Evaluation methodology (Fetterman et al. 1996), Menchaca’s evaluation triangulated data from multiple stakeholders (students, faculty, and administrators) and related the following major findings:

- Technology tools in distributed environments should appeal to multiple learning styles of students. Critical tools included: synchronous environments, asynchronous environments, and web-based content. Technology tools enhanced learning, creating an environment often superior to traditional formats.
- Appropriate strategies in distributed environments included: processing content, discussing content, problem-solving through collaboration, reflecting, and building a community of learning. Learning in a social context was critical to the success of online learning.
- Face-to-face interaction was crucial for establishing a community of learning.
- Tools and strategies complement each other, including using web-based media for processing content, using synchronous tools for discussing content, using synchronous tools for problem-solving through collaboration, using asynchronous tools for reflection, and using synchronous...
tools and face-to-face interaction for building community. The utilization of specific tools with appropriate strategies deepened student understanding and strengthened their ability to solve complex problems. (2002 p. xvii – xviii)

In order to better identify optimal delivery models, Menchaca posited that certain strategies worked best with certain tools and provided a graphic representation of how these tools and strategies interacted (Fig. 1). The following is an excerpt explaining the figure (Fig. 1):

Figure [1] displays the most effective tools and strategies and their interaction. The tools that students consistently determined to be most critical were: (a) face-to-face interaction, (b) synchronous communication, (c) asynchronous communication, and (d) web-based content. The strategies students consistently determined to be most effective were: (a) discussion, collaboration, and community-building, (b) reflection, and (c) assessment. The diagram displays how these tools and strategies typically interacted in the program. Recorded information, in the form of synchronous chat logs, asynchronous discussions, web-based content, email communications, multimedia presentations, and even face-to-face meetings, could be processed in many ways using the tools available. Certain tools worked best with certain strategies. For example, discussions, collaboration, and community-building were best conducted using synchronous tools or face-to-face interaction, while deep reflection was best accomplished using asynchronous tools. (p. 200)

Figure 1: A model for understanding the interaction of tools and strategies. (from Menchaca 2002 p. 201)

Although the matching of particular strategies to specific tools is useful when designing an online delivery model, one might take the study even one step further and match Gardner’s Multiple Intelligences with the four identified major categories of tools. In short, knowing that the Theory of Multiple Intelligence provides a powerful way in which to design curriculum, it might equally provide a comprehensive method for designing distributed
learning environments that appeal to students’ wide range of learning abilities. The following table (Tab. 1) links the categories identified by Menchaca with the Multiple Intelligences most likely addressed within those categories.

<table>
<thead>
<tr>
<th>Delivery Method</th>
<th>Multiple Intelligences Addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face interaction</td>
<td>Linguistic, Kinesthetic, Interpersonal</td>
</tr>
<tr>
<td>Synchronous interaction</td>
<td>Linguistic, Kinesthetic, Interpersonal</td>
</tr>
<tr>
<td>Asynchronous interaction</td>
<td>Linguistic, Logical, Intrapersonal, Interpersonal</td>
</tr>
<tr>
<td>Interaction with web-based content</td>
<td>Logical, Musical, Spatial, Intrapersonal</td>
</tr>
</tbody>
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Table 1: Matching Teaching Delivery Methods to Multiple Intelligences

Gardner (1993) notes that not all students possess all intelligences. However, most students have strengths and proclivities toward at least one, if not many, of the intelligences. Therefore, designing curriculum that integrates a broad spectrum of intelligences provides the greatest possibility for student success. Similarly, designing distributed learning environments that integrate multiple tools addressing multiple intelligences would necessarily provide the greatest possibility for students to achieve within the system because students with strengths in certain intelligences will thrive when engaging in those tools and strategies that directly address their intelligences. In short, using a theoretic approach based on multiple tools and intelligences could help design optimal distributed learning environments.

Below are two possible cases that illustrate the point.

Case 1: Miguel possesses strong abilities in the Kinesthetic and Interpersonal Intelligences. Relating this to the table (Tab. 1), Miguel most likely thrives in face-to-face and synchronous environments. He is motivated when he is able to move around and interact with others. In an environment where he is restricted to interacting only with content and engaging mostly in reflection, Miguel most likely would not fare well. However, in an environment in which he is offered multiple tools that engage multiple intelligences, Miguel can show an instructor he can do well in certain situations even if he might be challenged in others. Miguel does not have to be skilled and successful with every tool to achieve success in a multiple tool environment.

Case 2: May possesses a high degree of Logical and Intrapersonal Intelligence. She prefers to read and reflect on her own. She is shy and quiet in group settings. In the past, instructors have mistaken May’s shyness for a reluctance to participate in class and assumed she did not prepare adequately for discussions. In an online environment using multiple tools, May is able to reflect and participate without having to directly interact with her peers in a face-to-face setting. Instructors using asynchronous tools discover that May has a strong ability to synthesize multiple conversations and reflect deeply on course content.

While the two cases above are fictionally presented to merely illustrate a point, students possessing such intelligences certainly exist. A multiple tool, multiple intelligence approach to online delivery certainly would help such students succeed.

Conclusion

The ability to critically analyze tools and strategies and how these address multiple intelligences provides a firm basis for a theoretic approach to designing optimal delivery models for distributed learning. One might call such a theoretic approach: Post-Modern Distributed Learning Theory. Just as in Modern Portfolio Theory, students can have strengths (higher rate of return) in one tool while perhaps not faring well (negative rate of return) in another. However, by diversifying tool usage (spreading the risk), students can become successful overall (a positive, measurable rate of return over time).

Post-Modern Distributed Learning Theory (PMDLT) provides an interesting possibility for looking at the design and success of distributed learning environments. However, the Theory is only identified in this white paper and extensive further research must be conducted to determine specifics and its actual merit in practice. For example, the question of the optimal percentage of tool usage was left unanswered in the study conducted by Menchaca (2002). The study roughly allocated the identified tools in the following fashion:

- Face-to-Face Interaction 25%
- Synchronous Interaction 20%
- Asynchronous Interaction 33%
- Interaction with Content 22%
However, the study did not attempt to determine whether this was or was not an optimal configuration. That will be left for future research.

Finally, relating Post-Modern Distributed Learning Theory (PMDLT) to existing delivery models, one might predict that the most successful programs utilize a variety of tools and strategies. Conversely, one might also predict that the highest dropout or non-completion rates occur where delivery models rely heavily on too few tools (e.g., using web-based content and asynchronous interaction only). Further study should be conducted to see if PMDLT indeed is an accurate predictor of course or program success.

References


