

# Expert-to-Matrix: Improved Learning and Improved Outcomes in Principles of Marketing

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**Purpose of the Study.** Through the use of expert-to-matrix learning, a cooperative learning method, students practice teamwork, presentation, and critical thinking skills. This paper explains the use and outcomes in a Principles of Marketing course.

**Method/Design and Sample.** Over a six semester analysis, students had improved performance on exams while developing valued skills important to marketing professionals. Comprehension of course objectives was examined individually through traditional testing methods. Teams are evaluated on thoroughness and quality of their shared understanding of course objectives through class presentations.

**Results.** Students felt a higher level of involvement and responsibility in learning the course material than in other courses. Class grade distributions, based on objective test bank questions, were tightly clustered; and average grades were higher than those typical of a principles class taught without expert-to-matrix learning.

**Value to Marketing Educators.** Matrix learning improves performance, morale, and well-being of students. The technique is an example where students discuss concepts, seek explanations, and develop a common response to objectives that they present to others. They gain positive learning benefits such as empowerment and responsible association.

*Keywords:* Principles of Marketing, Cooperative learning

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In foundation courses, marketing principles, for example, instructors are responsible for developing demonstrable competence of multiple concepts and how those concepts create value (Solomon, Marshall & Stuart, 2008). Although performance is paramount, instructors also cultivate appropriate work skills. Hallmarks often cited as outcomes of a college education are ability to think critically, communicate well, and work well in teams. This paper examines the integration of expert-to-matrix learning in a marketing principles course as a vehicle for improving performance, developing teamwork, and strengthening critical thinking and communication skills.

Students prefer lecture courses and passive learning (Jones & Jones, 1998). The promise an emerging teaching pattern makes for developing critical thinking and strong communication skills frightens students because it might negatively impact grades (Badrinarayanan & Madhavara, 2008), but instructors can ease that fear by communicating the demand by employers for improved learning and application of content. Although many graduates report satisfaction with their education, they, based on reports from employers, lack fundamental knowledge and skills (Arum & Roksa, 2010; Fink, 2003; NPR Staff, 2011). This would denote suspicion that traditional teaching methods are not always effective. Grove and Fisk (1997) advocate participative

instruction; and while participation levels for instructors and students vary, participation by both is essential. Research suggests participative learning has a positive effect on students' attitudes (Curran & Rosen, 2006). When students take an active role in the development of other students' understanding, they, with their instructor's aid, enrich classroom experiences for all.

Assessment has motivated instructors to map program objectives to course content. Whether measured through tests or class projects, instructors attest students' learning ("Learning goals," 2011). Interestingly, however, employers report students are not well prepared to think critically or communicate appropriately. Employers also mention students' lack of self-direction, false impressions of global business, and insufficient teamwork skills (Conference Board, 2006; Gabriel et al., 1999; Hart, 2008; Johnson, Johnson, & Smith, 1991; Koncz, 2011; NACE, 2009, 2010).

Marketing graduates function as conduits between consumers and company personnel. They must communicate effectively and persuasively in advertising, public relations, sales, promotions, and marketing management (Bureau of Labor Statistics, 2009). Graduates must share thoughts and synthesize theories, actions, and data into workable solutions for their clients.

## THEORETICAL FRAMEWORK

In matrix organizations, functional managers assign employees to projects, while project managers assign employees tasks associated with the project. Project managers and functional managers share the responsibility of performance. This calls for a balance of power between the two.

Matrix learning is a technique that capitalizes on small group dynamics, which are usually present in an informal sense in almost every classroom. It builds on the collaborative learning technique of "Think-Pair-Share" (Lyman & McTighe, 1988) by mixing the groups formed between the pairing and sharing steps. It adds a retelling element, to enhance listening skills and further deepen the understanding of the concepts, suggestive of "Tell/Retell" cooperative interactions (Fogarty & Opeka, 1988). The difference is that in matrix learning, the group interaction is the teaching technique rather than a social or remediation technique (Goings & Krizan, 1988). The process forces even the most passive learner to become an active participant. Research has shown that students have an increased understanding of concepts through positive interactions with classmates (Lancor & Schiebel, 2008).

Cooperative learning, whereby students help each other learn concepts through face-to-face dialogue and discussion, encourages teamwork (Johnson & Johnson, 1994). The technique has been successfully demonstrated across disciplines. Richard Stonehouse (personal communication, January 1981), a professor of geology at Michigan State University recommended matrix learning as an innovative technique to reduce the tedium that can be present in traditional instruction. In addition, he supported matrix learning as a way to counteract the passivity of some students, making them an integral part of the teaching process, with peer pressure present to promote performance. The majority of students in legal environment of business classes responded positively to the use of expert-to-matrix learning when used to study bailment and contractual law (Goings & Johnson, 2011). Business communication classes with the same exercise responded even more positively to the approach, though not all performance measures supported the approach.

Using the expert-to-matrix technique in a graduate marketing foundations course, Fontenot (2010) found that though performance scores had reduced variation from the norm, average exam scores did not show significant improvements from a traditional lecture-based class of the same course by the same instructor. Two issues may have contributed to that outcome. One issue was a large number of the students failed to prepare prior to class. When pre-work is not completed by all team members, social loafing tends to occur (Michaelsen & Knight, 2004) and can become a norm for the group. Another issue may have been students' self-selection into groups and the large diversity across the class, (part-time vs. full-time

students, working students, large age differences, and high percentage (43%) of international students). Through self-selection, groups tended to be relatively homogenous within but heterogeneous across. The suggestion from this experience indicated expert-to-matrix learning method may be best suited for homogenous classes (Fontenot, 2010) or when possible for forced group membership with consideration given to diversity.

Expert-to-matrix learning uses a structure similar to that used in matrix organizations where students and teacher take on the responsibility of performance. The learning process is broken into parts by the teacher. Prior to class, students develop responses to assigned objectives and research beyond the text examples that add strength or support to the objective. At the beginning of a learning session, students gather in expert groups to compare and check their understanding. They then form different groups, called matrix groups, where each student contributes a different objective from the same material. Each student explains his or her concept to the others, allowing the entire group to learn the entire concept. Figure 1 illustrates a typical matrix learning structure, where there are four groups (Mighty Marketers, Innovative Solutions, Strategic Alliance, and Image Consults) each with four members.

Expert-to-matrix learning is a cooperative learning strategy. Each member of a matrix team is responsible for learning part of a subject or concept; he or she is also responsible for helping his or her teammates to learn.

Matrix learning offers many advantages. Webb (1982) stated that cooperative learning that takes place in matrix groups develops higher level thinking skills.

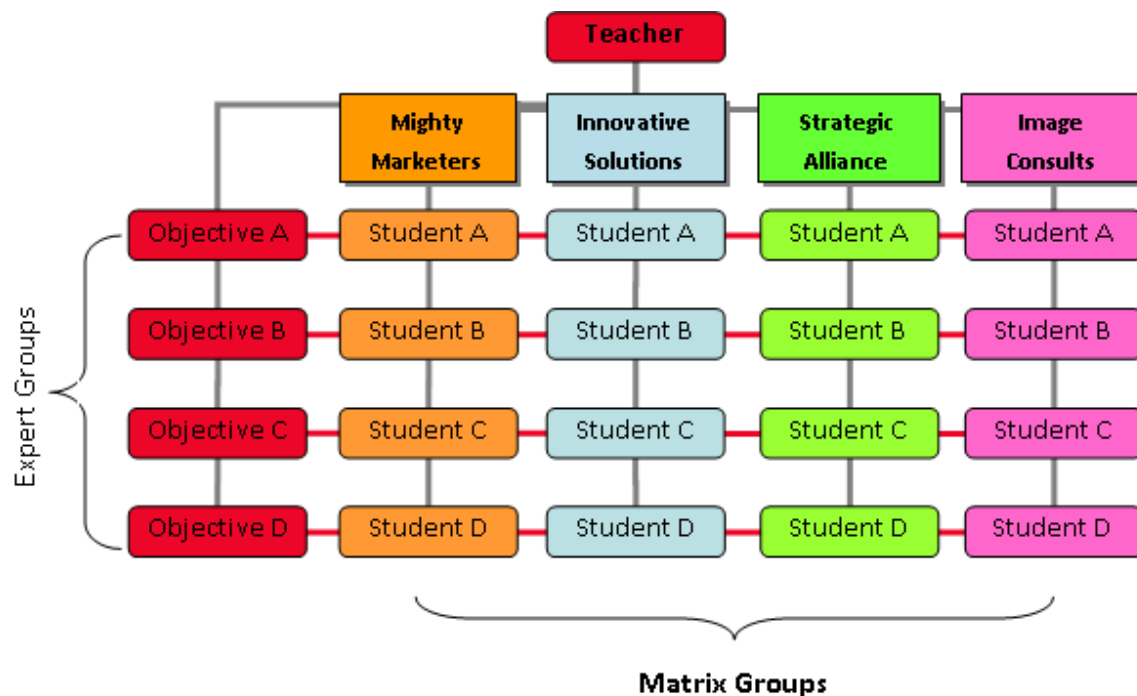
Nelson-LeGall (1992) argued that learning is the result of continuous, dynamic negotiation between students; and that social sharing of cognitive learning activities, like debate, enhance critical thinking skills. Students benefit from working in groups by expressing themselves. Typically more advanced students initiate analysis of the material, which stimulates critical thinking. Discussion and debate, with feedback, are benefits of matrix learning. Students share points of view, present arguments and counter arguments that enhance critical thinking skills without fear of embarrassment of being wrong. Such fear could curtail more active participation in a traditional classroom. Smith, Johnson, and Johnson (1981) confirmed the positive effects of cooperative learning. They contended that students achieve higher levels of understanding and retention when they share ideas and attempt to understand others.

Salvin (1990) argued that students should be actively involved in the learning process. Students become empowered as they share ideas, seek information, make decisions, and present findings—they learn, while they tutor their peers. When students are actively involved in their own learning, they are more likely to realize success. Aronson and Patnoe (1997) described a matrix learning method called

jigsaw as a way to improve students' mastery of material, attendance, self-esteem, and social responsiveness to classmates. They also pointed out

that the method results in greater empathy for others, including those of different races and genders.

**Figure 1: Illustration of Matrix Learning Groups**



The jigsaw method proposes learning as a series of pieces, each different but related, that must fit together to make a whole. Subject matter is divided into pieces, like a puzzle, that can be assigned to individuals to research and to master (Aronson, Blaney, Stephan, Sikes, & Snapp, 1978). After mastering their assigned part, individuals with the same assigned section meet to compare their responses. Then they return to their groups where each member has a different piece of the puzzle. Each member of this group is dependent upon each other to complete the knowledge puzzle. This method was initially developed as a way to build collaboration across individuals and specifically to build relationships across racially and ethnically diverse students.

As students work together, they create an interdependence that results in responsibility for each other. Teams, therefore, draw upon the talents and skills that each team member brings to the group. Pooling their abilities allows the team to explore more challenging content, while reducing the frustration often associated with individual exploration.

## METHOD

Matrix learning can be used at any level, with any size class. The process uses matrix groups and expert groups. Matrix groups consist of a cross-section of the class membership. Criteria to consider, when possible

might include academic, cultural, and racial diversity. Each member of a matrix group is given a sub-unit of a concept. Matrix groups break up into expert groups, where each member has the same sub-unit. In expert groups, students analyze, synthesize, and prepare to teach the members of their matrix groups. Teachers interested in experimenting with matrix learning can follow seven easy steps:

### **Expert-to-Matrix Implementation - Initial Preparation**

*Step 1:* Determine the objectives per learning period and divide into equal segments by the number of expert/matrix groups in the class. Using the chapter objectives can be a good starting point. Label the objectives A, B, C, D, . . . for each learning period. Figure 3: Expert Group Assigned Chapter Objectives shows how objectives, taken from the Principles of Marketing text, *Marketing: Real People, Real Choices* (Solomon, Marshall, & Stuart, 2008), have been condensed into four objectives per learning period/chapter. Though some chapters will have more or less than four objectives, the instructor can restructure objectives to capture the goal in segments that match the number of groups. The first column in Table 1 shows the expert group assigned to each objective. In this case, there are four objectives for each learning period, each learning period covers a single chapter, with expert(s) A (E, I and M) assigned

the first objective, B (F, J, N) assigned the second objective, and so on.

**Table 1: Expert Group Assigned Chapter Objectives**

Expert	Ch 1	Ch 2
<b>A (E/I/M)</b>	Explain the range of services and goods that organizations market	Explain the strategic planning process
<b>B (F/J/N)</b>	Explain value from the perspectives of customers, producers, and society	Describe the steps in marketing planning
<b>C (G/K/O)</b>	Explain the basics of marketing planning and the marketing mix tools used in the marketing process	Explain business planning and its three levels
<b>D (H/L/P)</b>	Explain the evolution of the marketing concept	Explain the key role of implementation and control on marketing planning

(Objectives taken from: Solomon, Marshall, & Stuart, 2008)

*Step 2:* Rank students on a measure of performance and assign students to matrix groups equal in number to the learning objectives per period, or in multiples of groups equal to the number of learning objectives. When possible the average score within a group should approximate the average across groups such that low performers are paired with higher performers. A pretest was administered the first day of class, the scores were not revealed to the students. If a ranking method is used, the academic ranking of any student should not be disclosed to the individual or class for reasons of confidentiality.

Table 2 shows how a class of 16 students could be ranked academically based upon a pretest score and then assigned to matrix groups. This procedure ensures that groups will be composed of students whose academic performance ranges from high to low (Salvin, 1977).

In the original jigsaw method, considerations for ethnic and racial diversity across groups were important criteria. Groups that self-select tend to

choose members who are most alike; the findings of Fontenot (2010) suggest that diversity across meaningful dimensions can produce improved outcomes. Academic performance can be a singular dimension that levels the teaching/learning across groups, challenging lower performing students to rise to the standards and expectations of their teammates.

*Step 3:* Regroup students into expert groups such that each expert group has a representative from a different matrix group. The number of expert teams should equal the number of matrix teams. Expert groups are identified by letters A, B, C, D, ... these correspond to the objectives. Expert A's are responsible for researching and developing a discussion to support objective A.

*Step 4:* Matrix groups should create team names. This is an opportunity to practice branding; the name will be used to identify the team throughout the semester. This creates team spirit, a sense of identity, and aids in the development of group dynamics skills.

**Table 2: Rank Ordering and Matrix Group Assignments for a Typical Class**

																Average	
<b>Score</b>	66	66	64	64	61	61	60	58	58	56	56	54	54	52	52	50	58.25
<b>Group</b>	1	2	3	4	4	3	2	1	1	2	3	4	4	3	2	1	
<b>Group</b>	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	
<b>Score</b>	66	58	58	50	66	60	56	52	64	61	56	52	64	61	54	54	
<b>Average</b>	58.0			58.5				58.3				58.3					

**Expert-to-Matrix Implementation - Classroom Management**

*Step 5:* At the beginning of each session, expert teams assemble and compare their prepared responses to their assigned objective. Group members then strengthen their responses through the input of the group’s members.

*Step 6:* After reasonable time has been given for expert teams to discuss their responses, individuals seek out their matrix group members. It is the responsibility of experts to assure that their matrix group members are conversant on their assigned objective. Group members must listen to each other carefully, question each other purposefully, and reinforce each other patiently in order to learn each of the objectives.

*Step 7:* Matrix groups are randomly assigned an objective to present to the class. Since all matrix groups should be prepared to discuss any of the objectives, the teacher now assigns each matrix group one of the objectives to present to the class. Knowing they will have to be knowledgeable to present as a team puts greater emphasis on group members to assure that everyone can contribute to an oral presentation. Through the presentation, the teacher can assure that the material was thoroughly and correctly understood. The instructor can interject and elaborate on objectives to increase the teaching impact as relevant to the objective.

**RESULTS**

The application of the expert-to-matrix learning process was applied in a Principles of Marketing course throughout a semester. Objectives for each chapter in the assigned text were chosen to capture the required foundational knowledge. Three sections of Principles of Marketing were used in this study, one section in each of three consecutive semesters.

In the first semester, there were 21 students assigned to five matrix groups of four students each, with one group having an extra member. The extra member, the lowest ranking student on the pretest, was assigned to the same expert and matrix groups

where the highest performing student was assigned. In the second semester, a summer semester, 15 students were assigned to four matrix groups with four students. One team was one member short; this was the team that had the highest performing student on the pretest. During the third semester, 31 students were assigned to eight matrix groups of four students each. As in the previous semester, one team was one member short; this team had the highest performing student on the pretest.

After a general lecture providing an outline of the chapter material and the scope of the important marketing concepts that a chapter covered, students entered into their expert groups to collaborate over their individually developed responses to the objectives assigned in the timeline to each expert group. After reasonable time was given for each expert group to develop a teachable response to the objective, including examples beyond the text, the experts joined their matrix groups. In matrix groups, each expert presented the response for his or her assigned objective and asked for questions to assure that all members understood the objective and could contribute to an oral presentation of the objective if their group were chosen to present it. After all matrix groups had covered the assigned objectives, matrix groups were then randomly assigned to present an objective, by draw of playing cards.

Each group presented its selected objective to the class. The matrix group had to first introduce each member, state its objective, describe its response to the objective, and give examples that supported the objective. The rest of the class was responsible for evaluating each of the presenting groups using a standardized matrix with five criteria: clarity of explanation; appropriate use of marketing terms and grammar; providing examples beyond the text; enunciation and eye contact; and teamwork, confidence and enthusiasm. Each of the five criteria was rated using a five-point scale of Excellent – Very Good – Good – Average – Poor. This assisted in encouraging active listening, a communication skill sought by employers (NACE, 2010).

**Table 3: Evaluation rubric of presenters**

<b>Matrix Group: Mighty Marketers, Chapter: 1</b>	
Clarity of Explanation - adequate depth and breadth	E --- VG --- G --- A --- P
Appropriate use of Marketing Terms and Grammar	E --- VG --- G --- A --- P
Beyond Text - provide examples, framing, giving context	E --- VG --- G --- A --- P
Enunciation and Eye Contact	E --- VG --- G --- A --- P
Teamwork, Confidence and Enthusiasm	E --- VG --- G --- A --- P

E = Excellent, VG = Very Good, G = Good, AV = Average, P = Poor

Each student was given a folder with a complete set of rubrics for each chapter to facilitate the process. The definitions of what constituted these ratings were discussed and established by the class at the beginning of the semester. Four times throughout the semester, in alignment with sections of material covered for exams, folders with rubrics were collected from students, results were entered into a master rubric, and each team was given feedback with the aggregate scores of their classmates and the comparative evaluation of the teacher.

Across each semester, the overall evaluations of each team improved across the measures demonstrating that the feedback helped steer groups to putting more effort into the areas where their evaluations were weak.

Since the content covered by the expert-to-matrix groups was the core material of the course, exam scores in the three classes, across multiple-choice based exams created from the text test bank, were compared to similar tests used in the same course in previous semesters when the expert-to-matrix method was not used. Comparing average

grades across five exams per semester, the Principles of Marketing course grades improved under the expert-to-matrix method. The teacher attempted to maintain a level of difficulty that was consistent across all administrations of the course in order to avoid biasing results. The average exam grade across all exams before using the expert-to-matrix technique was 72.46%. The average grade across the three semesters when the expert-to-matrix learning was applied was 78.86%.

As indicated in Table 4, expert-to-matrix students outperformed traditional lecture students with considerably better performances at test extremes. Furthermore, individual student test score data from expert-to-matrix classes were compared to the test score data from non-expert-to-matrix classes using a t-test. Analysis of the data indicated differing variances between the two groups so a t-test assuming unequal variances was applied. The comparison returned a t-statistic of 8.04; and given the 655 degrees of freedom from the sample, it was found to be significantly different at the  $p < 2.02E-15$  level.

**Table 4: Comparison of grade distributions**

<b>Individual Exam Grades</b>	<b>Expert-to-Matrix</b>	<b>Traditional Lecture</b>
Grades of 90+	16.2%	3.8%
Grades of 60-89	80.8%	87.2%
Grades of 59 or lower	3.0%	8.9%
<b>Total Number of Exams</b>	395	313

At the end of each semester, students in the expert-to-matrix learning classes were surveyed about their perceptions of the experience. Students were asked: “to what degree did [they] believe the expert-to-matrix learning prepared [them] for exams compared with more traditional teaching methods?” Fifty-five percent of students reported that they felt they were better prepared, 35% stated they felt they were prepared about the same, and 10% felt they were worse prepared. Students were asked if they “performed better in this class as a result of the expert-to-matrix learning as compared to other similar classes?” Fifty percent felt they did better, 35% felt they did about the same, and 15% felt they did worse. Interestingly, those who felt they did worse were generally, with only three exceptions, students who had performed in the top 10% on pretests.

Roughly 80% of the students provided feedback to the open-ended question asking for additional feedback. Over 60% of the comments were favorable versus a little less than 40% that were deemed to be neutral or negative. Positive comments had three common themes. Students expressed: they felt better

prepared because of the method, in part because they were responsible for teaching others; they enjoyed the group dynamics and interactions; and they encouraged continue use of the method and the desire for its adoption in other classes.

A couple of comments were neutral in their tone or limited in their depth, such as, “I feel the way we run class is adequate.” Not everyone had a favorable opinion of the expert-to-matrix experience. Negative comments had two themes. Some students expressed they preferred a traditional lecture style teaching and others expressed they did not like their group.

## **DISCUSSION**

Students in matrix groups are forced to help each other to become more articulate. The effect of each interaction allows students to realize that other students in their group have some worthwhile part to play in their education. This method strengthens these abilities. Through the expert-to-matrix method, students learn two important lessons: (1) none of them can do well without the aid of every other

student in their matrix group, and (2) each student has a unique and essential contribution to make.

Matrix learning requires teachers to prepare better units of instruction and to think differently about their role in instruction. For marketing instructors, it is important to understand the interplay between course and chapter objectives and the more holistic objective of preparing undergraduate students to be future marketing professionals.

Expert-to-matrix learning allows for a minimum of lecture and other teacher-controlled instructional techniques, thus limiting an instructor's opportunities to regale students with stories and examples of marketing from the teacher's own experience. Younger and less experienced instructors are more likely to engage in active teaching methods (Black, & Stewart-Wingfield, 2008). As one has greater experience, it may be harder to control the desire to share and to be seen as someone who is brilliant and thinks out loud. Others may hesitate to adopt non-traditional teaching methods for fear of less positive student evaluations at the end of a term. Evaluations tend to inversely relate to the demands of a class (Arum, & Roksa, 2010). The expert-to-matrix method forces some students out of their comfort zone and some negative teaching evaluations can result. This may be offset by increasing the role of the instructor in clarifying and strengthen the objective responses or augmenting sessions with more traditional examples so students get the "best of both worlds."

Using expert-to-matrix learning augments the knowledge that would typically be conveyed through traditional instruction by developing skills important for marketers. Once introduced to the technique,

students can use matrix learning for outside study sessions or apply it to other courses.

Creating expert and matrix groups can be done as easily with small to medium classes. The method allows and demands interactions from everyone, something that is often hard to achieve. It does not allow for individuals to withdraw or become passive as is common as groups increase in size. In large classes, there are physical limitations that can impede the ease with which the class moves from expert-to-matrix, and then to presenters. Small classrooms with flexible seating that allows for movement and flow are ideal. Typically, as class size increases there is reduced flexibility in seating and even more constrictions. Seating that is stationary, in tiers, or in long rows creates physical barriers that can be frustrating when individuals need to move between groups.

Expert-to-matrix learning increases performance, morale, and well-being of students. Numerous researchers have concluded that cooperative learning techniques are superior in terms of fostering group affection and respect (Aronson et al., 1978; Johnson et al., 1991). The technique allows students to take on some of the responsibility of their own education, a quality that seems to have escaped many students. Through the expert-to-matrix process, students develop skills of working in teams, analytical thinking, and oral communications. This better prepares students for the professional workplace by strengthening some of the desired skills sought by employers.

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