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# AN APPROACH TO FACILITATE PROBLEM SOLVING: INDIVIDUALIZING THE PROBLEM PROPOSITION

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# AN APPROACH TO FACILITATE PROBLEM SOLVING: INDIVIDUALIZING THE PROBLEM PROPOSITION

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## Abstract

This paper addresses one of the many facets of the problem-solving activity: the challenge inherent in the problem proposition. We have identified the problem proposition as a core element in obtaining efficient problem-solving. The Educational Dimension Portfolio, EDP, is our proposal for individualizing the problem proposition. This paper presents EDP's characteristics and implications through testing the results of 491 IESE Business School executives from the European Union (EU) and Latin America (LA). We enumerate five working hypotheses and show their results.

We also propose an *Educational Delivery Approach (EDA)* to help managers become manager-educators. We present the Socratic educational process, the apprenticeship process and providing alternatives process as a guide to become a manger-educator.

**Keywords:** problem solving, problem proposition, operations management, manager-educator.

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# AN APPROACH TO FACILITATE PROBLEM SOLVING: INDIVIDUALIZING THE PROBLEM PROPOSITION[1]

## Introduction

This paper addresses one of the many facets of the problem-solving activity: the challenge inherent in the problem proposition. We have seen managers assisting in problem solving, and the negative or positive outcome did not seem to have any connection to the problem content. We have identified the problem proposition as a core aspect in attaining adequate problem solution.

Some managers seem to be at a loss on how to handle their collaborators' problem-solving process. They resort to giving orders, believing this will provide a solution. World-class managers know how unproductive this path becomes. Twenty-first century companies have high knowledge-content workers, and giving orders is not the right approach to achieving results. A manager needs to unlock the problem-solving process and match the problem proposition to the individual singularities. The lack of understanding of how this proposition is unique to the individual can result in problems that do not convey the adequate challenge and thus are not solved.

A new role emerges: the role of manager-educator. One of its targets becomes the individualization of the problem-solving process and thus its proposition. Managers transform themselves into facilitators instead of order-givers. But no formal education has been provided to teach managers how to face this new challenge, and they struggle without understanding all the implications.

This paper presents our proposal to individualize the problem proposition. The Educational Dimension Portfolio, EDP, is the key to achieving this goal. This paper presents EDP's characteristics and implications. It also proposes an educating approach to help managers become manager-educators. We will present the Socratic educational process, the apprenticeship process and provide alternative processes as a guide to become a manger-educator.

[1] We would like to thank Nils van Wassenhove, Research Assistant of the Alcatel Chair at IESE, for his assistance in the analysis of the statistical data. We thank the Alcatel Chair for their support on this research.

The structure of the paper addresses, in the first instance, the theoretical background of the research. Then it enumerates the five working hypotheses of the research and the results. A special section covers the educating approaches we have found in the sample. Finally, we present our conclusions and the paths of further research that they open.

## Theoretical Background

Our starting point is adult learning, and how to improve a company's Operations by inducing that learning. A focal point of the approach proposes that adult learning is generated by problem solving (Hayes, Wheelwright and Clark, 1988). Problem-focused Operations (Muñoz-Seca and Riverola, 2005) are essential to achieving World-Class Operations. Problem-focused Operations contemplate the operational configuration and strategy, addressing issues of optimization, learning, knowledge utilization, organizational structure and improvement.

To generate learning, a problem needs to provoke an adequate challenge. A special area of research becomes how to deal with the individual characteristics of the learning process. Expanding on contributions by Kolb (1984), Anderson and Adams (1992, 1995) and Honey (1988), the Educational Dimensions Portfolio ("EDP") (Muñoz-Seca, 2003) presents a way to individualize the problem proposition. The problem proposition is adjusted to personal requirements. Problem solving becomes more efficient and less time-consuming.

EDP is a gallery of profiles that match any individual and is composed of four dimensions. The level of intensity of each dimension defines the EDP profile. Problem solving is induced through a different combination of these dimensions. The four EDP dimensions are:

1. *Delivering experiences (DE)*. The degree to which the individual can perceive, through the use of different sets of experiences, the possible immediate results and consequences of his problem-solving activity. This includes the possibility of having an immediate perception of the process's implications and real outcomes.

2. *Analyzing alternatives (AA)*. The degree to which the individual deepens the evaluation of the different alternative paths to follow. This requires anticipation of positive and negative effects for each alternative.

3. *Guiding through the process (GP)*. The degree to which the individual can make use of a guiding tutor who incrementally shows him how to perform and act. The process points out the steps and obstacles that the individual faces in his problem-solving activity.

4. *Providing knowledge (PK)*. The degree to which the individual requires a conceptual, abstract framework to relate the problem to. The framework is then a source of knowledge that will help him solve the problem.

A specific EDP combination provides the individual's gateway not only to his own learning but also to inducing learning in others. Entwistle (1991) argues that learning theories, and the practical applications of teachers' behavior illustrated by Kolb, show that teachers tend to teach using their own learning style. We adhere to the body of research that suggests that the learning style is equal to the educating style. Accordingly, EDP dimensions are involved both in accepting the problem proposition and in creating problem propositions.

Assume a manager wants to induce learning. If he acts spontaneously, he[2] will try to do it by applying his own EDP profile. If he is dealing with a person with the same profile, the problem proposition will be presented accordingly. Assume now that both have different profiles. The manager may be using the wrong approach to present the problem. This might create all sorts of difficulties; the most common one being miscommunication. The problem proposition is faced from different perspectives. Unless the manager is aware of EDP, he might not know how to deal with the impasse and fail in his attempt to get things solved. EDP not only provides us with the individual problem proposition profile but also with the educating, or problem generator, profile.

## The Study and the Hypotheses

EDP was previously tested (Muñoz-Seca, 2003) with 191 executives from Europe and Ecuador. The findings were attractive and some managers started to apply them. This led to some questioning on specific EDP characteristics.

This paper presents the testing results of 491 IESE Business School executives from the European Union (EU) and Latin America (LA). Our work has focused on proving or disproving five hypotheses. These hypotheses arose from questions and doubts that came with EDP implementation. Some relate to the nature of EDP and its relationship with differences such as gender, culture, experience or age. Others focus on EDP internal characteristics, the nature of the profiles or the relationships among dimensions.

The following five main hypotheses summarize these concerns:

*H1. Providing Knowledge (PK) would be the lowest dimension valued.*

Our previous research hinted that our business people population might have PK as the lowest dimension. The difference with the other dimensions was significant so we should hypothesize that we get the same findings. Theoretical approaches seem unappreciated in business life and the PK score should confirm this.

*H2. The ED profile should not be restricted to a single combination of values.*

Our previous testing showed a single combination of one dominant, two moderate and one weak. However we observed that EDP profiles were more complex. Just one combination seems an extremely oversimplified result. The mixing of profiles should be more varied. We propose that we will find different combinations of dimensions and values. This will prove the individuality of each EDP and would provide a more substantial understanding of the problem proposition.

*H3. EDP is stable in adult life. Experience and age might slightly modify the values but not with a significant difference.*

In certain cultures experience is very much valued and we were asked if EDP changed with age and experience. Mangers wanted to clarify if a more mature person had a more balanced EDP.

The fact that EDP could change with age and experience opened avenues of possibilities. A weak dimension could be modified and experience would become an invaluable asset. On the

[2] For the sake of simplicity, we will use "he" as a general gender term.

other hand, if EDP is stable, managers need to act promptly because age or experience will not change its composition.

*H.4. Geographical origin or gender does not modify EDP.*

World-Class Operations deals with different cultures. The cultural question becomes evident when working with both Latin American and European companies. We wanted to find if EDP had some cultural implications. Research (De Vita, 2001) had shown that learning styles and culture were interlinked. Hofstede (1983) presented four central dimensions of cultural variation. His proposal stated that management is heavily influenced by national cultural differences. For him, culture is "the collective programming of the mind which distinguishes one group (or country) from another" (Hofstede, 1993), and culture is "a construct inferable from verbal statements and other behaviors and useful in predicting still other observable and measurable verbal and nonverbal behaviour" (Hofstede, 1993). Hofstede's approach is clearly sociological and we did not see any relationship between his approach and ours, but the fact that he had found theses differences prompted us to analyze whether a cultural variation could also apply to EDP.

Additionally, we wanted to see if the gender component created dissimilarities. Some discussion has arisen lately on the need to differentiate education depending on gender (Waller, 2005). The term "feminist pedagogy" deals with the need of differentiation. We wanted to find out if these differences would also apply to the problem proposition and to our specific population.

Our hypothesis is that neither origin nor gender should modify EDP. We think the differentiating factor is the population specificity. Regardless of gender or geographical source, all IESE participants are well-educated individuals, hold a degree, and have similar business experiences. This will probably condition the sample and might become a stronger factor than gender or origin.

*H5. The four educational dimensions are independent.*

As a last hypothesis, we wanted to test the relationships among dimensions. This drove us to analyze whether the dimensions were independent or if some of them came paired with one another. Independence would suggest dealing with each dimension separately, where actions to improve one would not affect the other, whereas a dependency would show specific linkages among dimensions and complementarities among them.

# Measurement and Data

## Measurement

The EDP Questionnaire consists of 32 questions distributed into four groups of 8 questions corresponding to each Educational Dimension, ED. Each dimension is presented in the form of activities. Each question must be answered with "yes" or "no", and all questions must be answered for the questionnaire to be valid. Table 1 shows the questions and their relationship with each specific Educational Dimension.

## Table 1

EDP questionnaire and specific ED questions

| EDP Dimensions | Questions |
|---|---|
| Delivering Experiences (DE) | 1, 5, 9, 13, 17, 21, 25, 29 |
| Analyzing Alternatives (AA) | 2, 6, 10, 14, 18, 22, 26, 30 |
| Providing Knowledge (PK) | 3, 7, 11, 15, 19, 23, 27, 31 |
| Guiding through the process (GP) | 4, 8, 12, 16, 20, 24, 28, 32 |

The grading of the questionnaire consists of adding the positive answers of each corresponding dimension. Each dimension has a score ranging from 0 to 8. The scoring provides three values: dominant, moderate and weak. The sum of the "yes" answers scoring from 0 to 4 determines a weak value, the sum from 5-6 an average value, and the sum from 7-8 determines a dominant value. Each range of values provides a value 0 (weak), 1 (average) or 2 (dominant) which represents the final score for each ED.

## Data

A sample of 491 Spanish-speaking IESE participants took the Spanish web-based version of the EDP questionnaire, which can be found at http://webprofesores.iese.edu/BMS/BMS_Test/pdetest/. All data presented in this research is available upon request.

This sample is 80% male and 20% female. Participants came from two specific regions, EU and Latin America. Age ranged from 20 to 65, with 79% in the 30-50 age bracket (see Table 2).

## Table 2

Sample characteristics

| Program | % | Position | % | Age bracket | % |
|---|---|---|---|---|---|
| Specific In Company | 37.6 | General Manager | 10.4 | 20 – 30 | 17 |
| Executive Education | 14.5 | Manager | 8.5 | 30 – 40 | 47 |
| MBA | 10.0 | Section Head | 12.0 | 40-- 50 | 32 |
| EMBA | 37.9 | Department Head | 24.7 | 50 -- 65 | 5 |
| | | Other | 44.4 | | |

Almost 76% of the participants came from two sets of programs: the Executive MBA ("EMBA") and a Specific Company Program. The rest came from our regular MBA and different Executive Education Programs. All participants took the test on a voluntary basis. No special testing guidance was provided and some results were discussed privately.

# Results

*H1. Providing Knowledge (PK) would be the lowest dimension valued.*

## Figure 1

Bar chart of sum of weighted ratings for each educational dimension

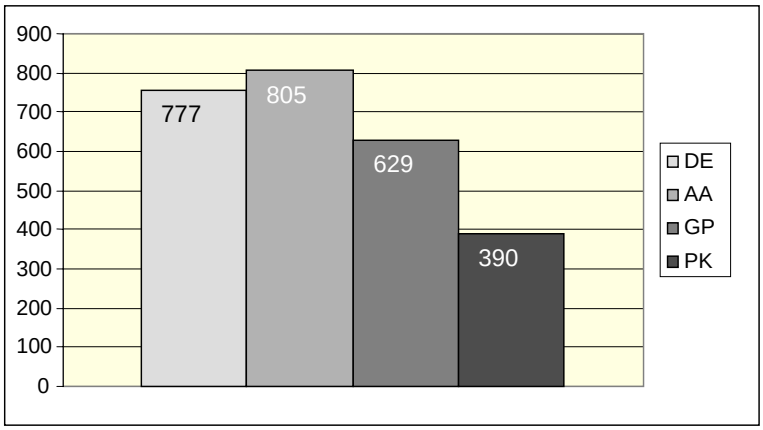



Figure 1 shows the bar chart for each dimension as the sum of weighted ratings.[3] This calculation can be viewed as a cumulative rating on each dimension and it allows us to compare the global importance of each dimension in the sample. This sum presents Analyzing Alternatives and Delivering Experiences as the highest valued (805 and 777) and Providing Knowledge as the lowest (390).

A frequency distribution (Table 3 and Appendix 1) shows that 70.3% of the sample valued *Analyzing Alternatives* with a 2 score and 64.8% had a 2 score in *Delivering Experiences*. 41.1% of the sample scored 0 in *Providing Knowledge*. The sum of score 0 and 1 in Providing Knowledge shows that 79.4% of the sample had that value.

## Table 3

Frequency distribution of ED values in the sample

| | DE | | PK | | AA | | GP | |
|---|---|---|---|---|---|---|---|---|
| | Freq. | % | Freq. | % | Freq. | % | Freq. | % |
| **0** | 32 | 6.5 | 202 | 41.1 | 31 | 6.3 | 70 | 14.3 |
| **1** | 141 | 28.7 | 188 | 38.3 | 115 | 23.4 | 213 | 43.4 |
| **2** | 318 | 64.8 | 101 | 20.6 | 345 | 70.3 | 208 | 42.4 |

This confirms Hypothesis 1. This sample, as our previous sample suggested, presents *Providing Knowledge* as the lowest valued dimension.

As a first conclusion we can suggest that business people have an aversion towards theoretical structures. We can assume that the choice of profession is guided by the personal predisposition. Furthermore, our sample shows no interest in theoretical schemes. Even though this is widely known among business world academics, this testing provides evidence of the fact. Any manager

[3] For example DE = 32*0 +141*1+318*2 = 777.

should be aware that any company training program that presents a heavy load of theoretical work will not be effective.

We should link this finding with the sample's highest-valued dimensions. Highly-valued AA and DE show participants relating more to an active education focused on solving experiences. This ratifies the case method as the most adequate way of teaching business people. Moreover, managers need to start thinking about predominantly activity-based training. Theoretical courses should be restricted to conveying knowledge for a specific gap that blocks a problem solution.

*H2. The ED profile should not be restricted to a single combination of values.*

A multiple correspondence analysis presents 63 profiles. The frequency distribution shows that 86% of the data is contained within 28 profiles (Table 4). The rest of the population conforms to 35 remaining profiles, each of them containing less than 1% of the total sample.

The respondents answered positively to a large number of questions and 50% of the sample scored 2 values. Participants tend to have ED profiles with several preferences. The most common profile is a combination of dominant AA and DE (score 2), dominant or average GP (scores 2 or 1) and weak or average (scores 0 or 1) PK. A total of 18 profiles are not represented in our sample. Those profiles are mainly composed of either a dominant PK, or a weak DE and AA dimensions.

## Table 4

Frequency distribution of 28 most frequent profiles

| DE | AA | PK | GP | Frequency | % Freq. |
|---|---|---|---|---|---|
| 0 | 2 | 0 | 1 | 6 | 1.22 |
| 1 | 1 | 0 | 0 | 6 | 1.22 |
| 1 | 1 | 0 | 1 | 9 | 1.83 |
| 1 | 1 | 1 | 2 | 10 | 2.04 |
| 1 | 2 | 0 | 0 | 11 | 2.24 |
| 1 | 2 | 0 | 1 | 15 | 3.06 |
| 1 | 2 | 0 | 2 | 8 | 1.63 |
| 1 | 2 | 1 | 0 | 7 | 1.43 |
| 1 | 2 | 1 | 1 | 16 | 3.26 |
| 1 | 2 | 1 | 2 | 16 | 3.26 |
| 1 | 2 | 2 | 0 | 5 | 1.02 |
| 1 | 2 | 2 | 1 | 9 | 1.83 |
| 1 | 2 | 2 | 2 | 7 | 1.43 |
| 2 | 0 | 1 | 1 | 5 | 1.02 |
| 2 | 1 | 0 | 0 | 6 | 1.22 |
| 2 | 1 | 0 | 1 | 20 | 4.07 |
| 2 | 1 | 0 | 2 | 10 | 2.04 |
| 2 | 1 | 1 | 1 | 12 | 2.44 |
| 2 | 1 | 1 | 2 | 6 | 1.22 |
| 2 | 1 | 2 | 2 | 5 | 1.02 |
| 2 | 2 | 0 | 0 | 8 | 1.63 |
| 2 | 2 | 0 | 1 | 46 | 9.37 |
| 2 | 2 | 0 | 2 | 27 | 5.50 |
| 2 | 2 | 1 | 0 | 6 | 1.22 |
| 2 | 2 | 1 | 1 | 38 | 7.74 |
| 2 | 2 | 1 | 2 | 52 | 10.6 |
| 2 | 2 | 2 | 1 | 11 | 2.24 |
| 2 | 2 | 2 | 2 | 47 | 9.57 |
| **Sum** | | | | 424 | **86.35** |

These findings validate hypothesis 2. Previous research (Muñoz-Seca, 2003) provided a single combination of profiles: a dominant ED, two average and one low. Only 12.22% of our current sample has this specific combination. The mapping of the profiles in a 2-dimensional Factor Analysis shows that a large part of the sample has a profile with "high or average" scores. A 2-factor analysis graph (Appendix 2) presents, in the upper right part of the graph, 11 profiles containing 39.5% of the sample with at least 2 high-rated dimensions and no low-rated dimensions. The lower left side of the graph shows 8 profiles containing 4.9% of the sample with no high-rated dimension and at least 2 low-rated dimensions.

We clustered the most frequent profile combination not taking into consideration any specific ED. The data showed (Appendix 3) that 92.9% of the sample had two or more dominant EDs. Table 5 shows a summary of the most frequent profiles.

## Table 5

Percentage of most significant Profiles

| | ED PROFILE | | |
|---|---|---|---|
| **Percentages** | **Dominant** | **Average** | **Weak** |
| 17.00% | 2 | 1 | 1 |
| 15.30% | 3 | 1 | - |
| 14.70% | 2 | 2 | - |
| 12.22% | 1 | 2 | 1 |
| 9.57% | 4 | - | - |

We can say that H2 is confirmed. These findings could explain why some managers are more predisposed to facilitate the learning process than others. With four dominant educational dimensions, a manager can guide a more fluid problem-solving process. He can individualize the problem proposition to any desired combination. On the other hand, 7.1% of the sample did not have a dominant ED. They represent managers with a high difficulty in individualizing the problem proposition and probably hiding their dysfunction behind the (presumably) tough façade of order-givers.

*H3: EDP is stable in adult life. Experience and age might slightly modify the values but not with a significant difference.*

We correlated each ED with experience and age. Table 6 shows that, with the exception of the PK and experience, the correlations are not significant.

## Table 6

Kendall's tau_b correlations between EDs, age and experience

| | | Experience | Age | DE | AA | PK | GP |
|---|---|---|---|---|---|---|---|
| **Experience[a]** | Correlation Coefficient | 1.000 | .678(**) | -0.044 | 0.023 | .131(**) | -0.031 |
| | Sig. (2-tailed) | . | 0.000 | 0.334 | 0.613 | 0.003 | 0.486 |
| | N | 360 | 359 | 360 | 360 | 360 | 360 |
| **Age** | Correlation Coefficient | .678(**) | 1.000 | -0.032 | 0.031 | 0.062 | 0.004 |
| | Sig. (2-tailed) | 0.000 | . | 0.503 | 0.529 | 0.189 | 0.939 |
| | N | 359 | 359 | 359 | 359 | 359 | 359 |
| **. Correlation is significant at the 0.01 level (2-tailed). | | | | | | | |

To further analyze the correlation between PK and experience, we performed a Spearman Rank (Table 7).

## Table 7

Spearman Rank among PK and experience

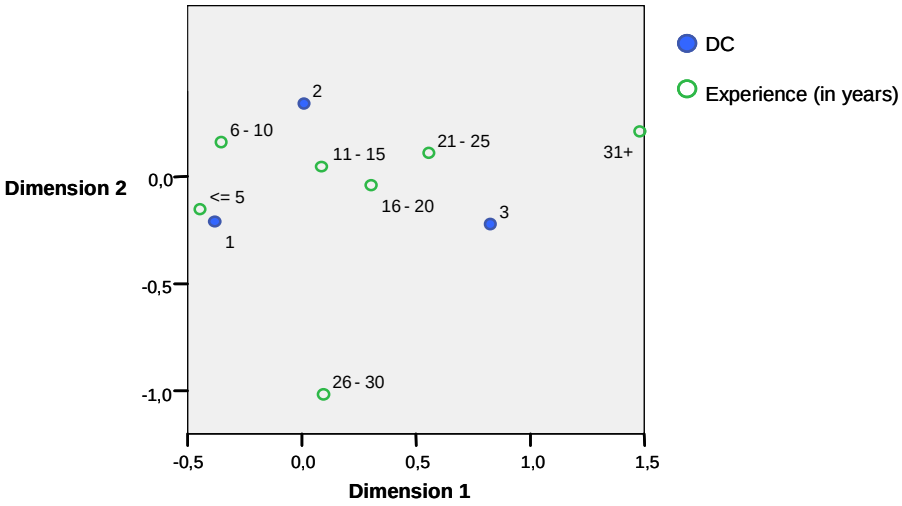
| | | DE | AA | PK | GP |
|---|---|---|---|---|---|
| **Experience** | **Correlation Coefficient** | -.051 | .027 | .154(**) | -.037 |
| | **Sig. (2-tailed)** | .332 | .613 | .003 | .485 |
| | **N** | 360 | 360 | 360 | 360 |

** . Correlation is significant at the 0.05 level (2-tailed). 95% confidence interval.

We then performed a simple correspondence analysis. This analysis describes the relationships between PK and experience in a low-dimensional space, while simultaneously describing the relationships between the categories for each variable. We can observe a linear pattern between experience and the rating obtained on the PK (Figure 2). The first dimension describes more than 87% of the total variance; the second dimension adds the remaining. The more experience a person gathers, the higher PK becomes. The relation between experience and PK is even clearer when applying the simple correspondence analysis to an experience variable organized in larger brackets (10 years instead of 5 years).

## Figure 2

Simple Correspondence plot between PK and Experience




To further probe the relationship with age, we analyzed the correlations among dimension taking into consideration the different age brackets. We have variations between GP and DE as their correlations tend to increase with age. This correlation is inexistent for the EMBA (37.60% of the population) and important for the Specific Company Program (SCP) (37.88% of the population). The data might suggest that there is a link between age and the GP/DE, as SCP participants are on average situated in an older age bracket than the EMBA participants. Further testing is needed to corroborate this point.

## Table 8

Kendall's tau b. Correlation among ED and age

| Age | | DE | AA | PK | GP |
|---|---|---|---|---|---|
| 20-30 | DE | 1,000 | 0,130 | 0,051 | 0,044 |
| | AA | 0,130 | 1,000 | 0,203 | -0,031 |
| | PK | 0,051 | 0,203 | 1,000 | 0,230 |
| | GP | 0,044 | -0,031 | 0,230 | 1,000 |
| 30-40 | DE | 1,000 | 0,140 | 0,010 | ,231(**) |
| | AA | 0,140 | 1,000 | 0,120 | ,184(*) |
| | PK | 0,010 | 0,120 | 1,000 | ,170(*) |
| | GP | ,231(**) | ,184(*) | ,170(*) | 1,000 |
| 40-50 | DE | 1,000 | 0,098 | 0,043 | ,306(**) |
| | AA | 0,098 | 1,000 | 0,161 | 0,060 |
| | PK | 0,043 | 0,161 | 1,000 | ,292(**) |
| | GP | ,306(**) | 0,060 | ,292(**) | 1,000 |
| 50-65 | DE | 1,000 | 0,302 | 0,031 | ,524(*) |
| | AA | 0,302 | 1,000 | 0,447 | ,461(*) |
| | PK | 0,031 | 0,447 | 1,000 | 0,387 |
| | GP | ,524(*) | ,461(*) | 0,387 | 1,000 |
| Sample | DE | 1,000 | ,124(**) | 0,027 | ,204(**) |
| | AA | ,124(**) | 1,000 | ,163(**) | ,123(**) |
| | PK | 0,027 | ,163(**) | 1,000 | ,250(**) |
| | GP | ,204(**) | ,123(**) | ,250(**) | 1,000 |

*. Correlation is significant at the 0.05 level (2-tailed). 95% confidence interval.
**. Correlation is significant at the 0.01 level (2-tailed). 99% confidence interval.

These findings do not confirm Hypothesis 3. Some EDs show an increase in correlation with age. We have also found a low but significant correlation between PK and experience. The most important finding is that experience becomes an important factor with respect to Providing Knowledge. This could suggest that companies should designate the most experienced people to assist challenging individuals with theoretical inclinations.

Age seems to influence the correlation among DE and GP, but the rest of EDs seem to be stable. This would drive us to say that the sooner the manager understands his profile, the better. The important fact is to find the weakest dimension. This will help in understanding why he does not achieve the results he desires. As experience only affects the PK dimension, the other dimensions will be similar during the whole professional life, and the ED profile will not be substantially modified. Thus, positive actions should be taken to compensate for the weak dimensions.

As an example, a manager can make a conscious effort in dealing differently with collaborators who have strengths were he has weaknesses. Muñoz-Seca and Sánchez, (2001) suggested that the weakness of one dimension could be modified with the use of technology. For instance, a manager with a weak DE could facilitate the problem proposition through discussion groups, in which other participants would deliver their experiences, or create virtual labs or promote the use of simulations to experiment experiences. If the weakness is in GP, technology can provide tutorial systems or interactive assistants that could be developed to individualize the problem proposition.

*H4. Geographical origin or gender do not modify EDP.*

We tried to detect differences between the Latin-American and the European population.

## Table 9

Spearman Rank Correlation among LA and EU EMBA participants

| Origin | | DE | AA | PK | GP | Experience[a] |
|---|---|---|---|---|---|---|
| EU | DE | 1.000 | .203(**) | 0.053 | .272(**) | 0.003 |
| | AA | .203(**) | 1.000 | .206(**) | 0.130 | 0.123 |
| | PK | 0.053 | .206(**) | 1.000 | .265(**) | .227(**) |
| | GP | .272(**) | 0.130 | .265(**) | 1.000 | 0.033 |
| | Experience[a] | 0.003 | 0.123 | .227(**) | 0.033 | 1.000 |
| LA | DE | 1.000 | 0.023 | 0.072 | .370(**) | -0.043 |
| | AA | 0.023 | 1.000 | 0.094 | -0.011 | 0.055 |
| | PK | 0.072 | 0.094 | 1.000 | .293(*) | 0.198 |
| | GP | .370(**) | -0.011 | .293(*) | 1.000 | -0.042 |
| | Experience[a] | -0.043 | 0.055 | 0.198 | -0.042 | 1.000 |
| Sample | DE | 1.000 | .130(**) | 0.029 | .220(**) | -0.051 |
| | AA | .130(**) | 1.000 | .176(**) | .132(**) | 0.027 |
| | PK | 0.029 | .176(**) | 1.000 | .275(**) | .154(**) |
| | GP | .220(**) | .132(**) | .275(**) | 1.000 | -0.037 |
| | Experience[a] | -0.051 | 0.027 | .154(**) | -0.037 | 1.000 |

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).
[a] Experience in year brackets.

The analysis of this subgroup was performed on 249 individuals who had identified their origin, 70% from the EU and 30% from LA. A Spearman Rank Correlation (Table 9) shows some slight differences. These are concentrated in DE and AA, AA and PK, and PK and experience.

To probe further into the differences, we performed a frequency distribution and a Pearson chi-square. We wanted to test the hypothesis that the origin (row) and Educational Dimensions (column variables) were independent (Appendix 4). The asymptotic significance of the chi-square statistic are greater than 0.05, so it is safe to say that they are independent. The results indicate that origin does not influence the Educational Dimensions.

We can validate the first part of hypothesis 4 and say that there seem to be no ED differences based on geographical origin. However, we must stress the fact that testing was performed among two populations with similar educational backgrounds and aims in life. This might heavily weight the results. We also have to remember that the LA executives might have more similarities with Europeans than with other areas of the Globe. Testing with different types of population might show significant differences. Further research should be contemplated on this issue.

We then tested correlations among the ED and gender. A Spearman Rank Correlation analysis with a confidence interval 95% (table 10) shows some differences between genders. The male sample follows the same correlations as the sample, but the size of the female sample (20% of the population) might be skewing the results.

## Table 10

Spearman Correlation among gender

| Gender | | DE | AA | PK | GP | Experience [a] |
|---|---|---|---|---|---|---|
| Male | DE | 1.000 | .172(**) | 0.038 | .197(**) | -0.013 |
| | AA | .172(**) | 1.000 | .180(**) | .144(**) | -0.006 |
| | PK | 0.038 | .180(**) | 1.000 | .271(**) | .140(*) |
| | GP | .197(**) | .144(**) | .271(**) | 1.000 | -0.042 |
| | Experience[a] | -0.013 | -0.006 | .140(*) | -0.042 | 1.000 |
| Female | DE | 1.000 | 0.010 | -0.039 | .313(**) | -0.122 |
| | AA | 0.010 | 1.000 | 0.151 | 0.091 | 0.145 |
| | PK | -0.039 | 0.151 | 1.000 | .261(*) | .291(*) |
| | GP | .313(**) | 0.091 | .261(*) | 1.000 | 0.008 |
| | Experience[a] | -0.122 | 0.145 | .291(*) | 0.008 | 1.000 |
| Sample | DE | 1.000 | .130(**) | 0.029 | .220(**) | -0.051 |
| | AA | .130(**) | 1.000 | .176(**) | .132(**) | 0.027 |
| | PK | 0.029 | .176(**) | 1.000 | .275(**) | .154(**) |
| | GP | .220(**) | .132(**) | .275(**) | 1.000 | -0.037 |
| | Experience[a] | -0.051 | 0.027 | .154(**) | -0.037 | 1.000 |

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).
[a] Experience in age brackets.

We then performed a frequency distribution and a Pearson chi-square among the two populations (Appendix 5). The values are greater than 0.05, so it is safe to say that they are independent.

To summarize, we have observed no significant differences between Europeans and Latin-Americans and we have found no gender differentiation. This would drive us to conclude that the dimensions are unaffected either by culture or gender in the business world. These findings would prove that, even though cultures might differ in mores, the deep rooted ED profile is similar in similar groupings of the Western World. Our findings might drive us to conclude that cultural differences could be more rooted in the knowledge base than in the problem proposition.

Finally, we would like to remind the reader that the similarities in educational background and jobs might override all other differences. We would recommend another testing with populations that are totally different in occupations or educational background. Also, the low percentage of females in the sample might affect the results.

*H5: The four EDP dimensions are independent.*

The cross-tabulations (Appendix 6) of the educational dimensions did not allow us to conclude any clear relationship between the EDs. Table 13 shows the correlation among dimensions. All dimensions, except PK and DE, show weak but significant correlation.

## Table 11

Spearman Rank Correlations among ED

| | | DE | AA | PK | GP |
|---|---|---|---|---|---|
| **DE** | Correlation Coefficient | 1.000 | .130(**) | .029 | .220(**) |
| | Sig. (2-tailed) | . | .004 | .525 | .000 |
| **AA** | Correlation Coefficient | .130(**) | 1.000 | .176(**) | .132(**) |
| | Sig. (2-tailed) | .004 | . | .000 | .003 |
| **PK** | Correlation Coefficient | .029 | .176(**) | 1.000 | .275(**) |
| | Sig. (2-tailed) | .525 | .000 | . | .000 |
| **GP** | Correlation Coefficient | .220(**) | .132(**) | .275(**) | 1.000 |
| | Sig. (2-tailed) | .000 | .003 | .000 | . |
| ** The significant (Spearman Rank) correlations are double flagged by SPSS. Confidence interval 95%. | | | | | |

To further analyze the relationship, we performed a Kendall's tau-b test. Table 12 shows results similar to those obtained with Spearman Rank.

## Table 12

Kendall's tau_b Correlations among EDs

| | | DE | AA | PK | GP |
|---|---|---|---|---|---|
| **DE** | Correlation Coefficient | 1.000 | .124(**) | 0.027 | .204(**) |
| | Sig. (2-tailed) | . | 0.004 | 0.523 | 0.000 |
| **AA** | Correlation Coefficient | .124(**) | 1.000 | .163(**) | .123(**) |
| | Sig. (2-tailed) | 0.004 | . | 0.000 | 0.003 |
| **PK** | Correlation Coefficient | 0.027 | .163(**) | 1.000 | .250(**) |
| | Sig. (2-tailed) | 0.523 | 0.000 | . | 0.000 |
| **GP** | Correlation Coefficient | .204(**) | .123(**) | .250(**) | 1.000 |
| | Sig. (2-tailed) | 0.000 | 0.003 | 0.000 | . |

**. Correlation is significant at the 0.01 level (2-tailed).
[a] Experience in years.

Besides Kendall's tau-b we also used Gamma (symmetric) and Somers' d (directional) ordinal correlation measurements to confirm the obtained results. Reading of bivariate correlation coefficients showed that, although all pairs of variables were positively correlated, we did not observe any significant high correlation levels among them. Through the principal components analysis for categorical data (CATPCA), we found that DE and PK are antagonists with opposite loadings (Appendix 7). Even though the correlations among dimensions were low we found that GP shows a higher correlation with DE/PK, and AA shows a significant low correlation with DE/PK/GP. There is no linear correlation between PK and DE.

We decided to use Pearson's chi-square test for independence to find out if the observed correlations (positive but low intensity) between ED were due to chance or reflect truth relationship between variables. High Pearson's chi-square values (Appendix 8) associated with low asymptotic significance values (generally Asymp. Sig. <0.05) confirms a truth relationship between the tested variables.

We then performed the Principal Components of the Factor Analysis. Factor Analysis with two factors accounts for only a little more than 61% of total variance. Three factors seem more appropriate for a relevant analysis (83.77%). The first observation is that, even with three factors, we still have more than 16% of variance left (Appendix 9). This might point to the fact that all four educational dimensions are weakly correlated, which confirms the calculated correlations between the dimensions.

When keeping three factors, and using the Varimax Rotation method to maximize the differences between variable projections on the factors, we confirm the correlations observed between the educational dimensions. Thus PK and DE are independent and GP is positively correlated with DE and PK.

H5 is partly validated. PK and DE are independent variables. The rest of the ED are positively but weakly correlated. The discussion arises if the weak values could disconfirm our hypothesis of independency. Some (Roth et al., 1998) might say that the correlations are significant enough to show dependency among some ED. Some others will not agree (Mendenhall 1971). Even though this is an open discussion, we would adhere to saying that only PK and DE are independent. The rest show some slight dependency.

## The Educational Delivery Approach

A manager-educator gears the educational experience to finding solutions to improve business performance. He assists others in problem-solving to improve service, and this improvement generates learning. It is a win/win situation. The company improves and the individual obtains his most precious asset: knowledge. The manager achieves a better performance guiding others into solving problems. He becomes an 'orchestral conductor' generating solutions from his "brain workers".

The data has provided us with a deeper understanding of EDP and its characteristics. EDP has given us a framework to understand individualities both as problem solvers and as problem generators. But to become a manager-educator requires not only to understand EDP but also to guide others through the problem-solving process. To do so, managers need to find processes that can become their guideline. In this context we are no longer dealing with the problem proposition. We are focusing on how to help and assist collaborators.

In this section we will address the approaches a manager-educator can take in guiding others through problem-solving. The data has provided us with an answer. It has shown three components that behave like independent variables (Table 13). The first should be seen as a variable mixing PK and GP, the second as a variable combining DE and GP and the third is equivalent to AA.

## Table 13

Three components found through Rotated Component Matrix

| | Component | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| DE | -.033 | .914 | .123 |
| AA | .099 | .096 | .974 |
| PK | .867 | -.146 | .181 |
| GP | .672 | .516 | -.091 |

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 4 iterations.

The mean (average coordinate of the profiles) on the first factor is negative, while it is positive for the two other factors. This observation confirms that Factor 1, combining characteristics of PK and GP, is still the lowest-rated factor.

There is no clustering of the ED profiles in function of a single factor. Most participants combine three factors. Once projected onto the factors, the profiles can combine high coordinates on two factors, and low or average on one factor. The data does not provide any significant relationships among factors and profiles.

Our proposition is that these factors or components are educational approaches. We will call these components the *Educational Delivery Approaches* (EDA). Each component becomes an EDA and provides a guide to apply EDP. Each EDA can be viewed as an educating process, focusing on provoking problem-solving and conveying learning. A manager-educator can achieve his goals through three different modes: the Socratic educational process, the Apprenticeship process or the Providing Alternatives process.

- *Socratic educational process*

  It is confirmed by a high PK and GP. The manager guides the problem-solving process through questions and provides knowledge in an interactive manner. The core of the Socratic Method is questioning. By following up all answers with further questions, and by selecting questions that advance the discussion, the Socratic method forces one to think in a disciplined manner, while continually aiding by posing facilitating questions.

- *Apprenticeship process*

  It is obtained by a high DE and GP. The pupil learns from experience and is guided through the problem-solving process. In workforce terminology, apprenticeship is a combination of on-the-job training (OJT) and related classroom instruction under the supervision of a journey-level craftsperson or trade professional through which workers learn the practical and theoretical aspects of a highly-skilled occupation. Translating this to brain workers, the manager-educator performs joint problem-solving to assist in the process and provides (or facilitates) knowledge to fill the knowledge gaps.

- *Providing Alternatives*

  The learning process is guided through the analysis of different alternatives which are sequentially clarified to develop an answer to the problem. The manager-educator assists in the formulation of alternatives and questions the possibilities that are enumerated.

A manager can view his role as educator through the prism of these three processes. Going one step further, if we accept that the personal EDP guides the educating style, we can suggest that individuals could have specific strengths in one EDA. An EDP with a high PK or GP would be more prone to use a Socratic EDA; those with a high DE and GP would lean towards apprenticeship, and a high AA towards providing alternatives.

These findings would also help any manger in detecting his weaknesses. His lack of efficiency might be caused by the weakness of one of the EDA components. Thus his efforts should be concentrated into finding ways to provide this lacking component.

A factor that also should be taken into consideration with the use of Educational Delivery Approach is the company's organizational culture. An open, flat-structured, flexible company will probably be more in tune with the apprenticeship approach. This type of company values management roles as facilitators. A more rigid, rank-oriented company will probably accept the Socratic approach with less difficulty. In it a manager retains much of his authority in the knowledge he shares with his collaborators, and his role is viewed more as a knowledge provider.

Finally, we should not forget that this is a bidirectional relationship. The manager might feel more comfortable with a specific EDA but the individual needs to be in tune with it. Each individual will feel more comfortable receiving each EDA depending on his highest ranked EDs.

It is very possible to relate these processes to a classroom educational experience. We have reviewed these components with some colleagues and we have clearly identified teaching approaches in different courses. For instance, a course the current author teaches in Operations Strategy clearly follows the Apprenticeship process. On the other hand, a colleague who teaches Operations Management is more focused on providing knowledge and is thinking of putting more emphasis on the guiding through the process dimension. An accounting course might be more inclined to analyze the different alternatives at hand. In our sample with a high ranked score in DE and AA, the most successful educational approaches should be apprenticeship and providing alternatives.

We have tried to validate this assessment but we have encountered one main difficulty: how to measure the success of a course. Even though at IESE our participants grade each course, there is an internal debate if this is the adequate measure for success. It is widely known and discussed that education cannot be evaluated on a short-term basis and that some courses with negative grading have caused the deepest educational impact on students. Nonetheless, the last two years our EMBA students have scored DE and AA as the highest value. And our operations strategy course which follows the Apprenticeship process has been one of the highest-valued.

## Summary and Further Research

Improving a company's operational performance requires constant problem-solving. An efficient problem-solving process requires an individualized problem proposition. To achieve this individual approach, managers need to explore a new role: manager-educators. They become translators of the surrounding realities to the individual singularities. In this new role,

manager-educators adapt the problem proposition to the individual profile. This paper has presented the Educational Dimensions Portfolio, EDP, and its characteristics and implications as a way to achieve this individualization. EDP was proposed in a previous research, but the present paper clarifies some elements that have arisen in the EDP implementation.

The testing of 491 IESE Spanish-speaking executives, both from the EU and Latin America, has been the proving-ground for these clarifications. Five hypotheses have been tested. The first one shows that business people seem less prone to theoretical frameworks, and this validates our previous findings.

The second hypothesis addressed the relationship among the dimensions. The highest-rated EDs are Analyzing Alternatives and Delivering Experiences. Only Providing Knowledge and Delivering Experiences are independent variables. The rest perform in a dependent manner. The low correlation values recommend further testing to confirm this result.

The third hypothesis analyzed the profile composition. The EDP profile is not restricted to a single set of values or preferences. The data shows ED profiles with several combinations ranging from four dominant dimensions to none. Almost 57% of the sample has two or more high-valued EDs.

Our population did not show any EDP differentiation based on country of origin. Gender and age were also irrelevant, although the small female sample suggests further validation of this outcome.

Providing knowledge is the only ED that shows some correlation with experience. We concluded that EDP remains stable in adult life. This fact would stress the importance of identifying weak EDs. The aim is to find alternative ways of delivering assistance for addressing a manager's weaknesses.

Finally, the data provided us with three components that were understood as Educational Delivery Approaches. We have called them the *Socratic educational process*, the *Apprenticeship process* and *Providing alternatives process*. They become a guide to following the manager-educator approach.

Further research needs to assess the importance of the EDAs on becoming a manager-educator. This is a new avenue in our research that we will pursue in due course.

# Appendix 1

Frequency Distribution of Educational Dimensions

DE

| | | Freq. | Percent | Valid Percent | Cumulat. Percent |
|---|---|---|---|---|---|
| Valid | 0 | 32 | 6.5 | 6.5 | 6.5 |
| | 1 | 141 | 28.7 | 28.7 | 35.2 |
| | 2 | 318 | 64.8 | 64.8 | 100.0 |
| | Total | 491 | 100.0 | 100.0 | |

PK

| | | Freq. | Percent | Valid Percent | Cumulat. Percent |
|---|---|---|---|---|---|
| Valid | 0 | 202 | 41.1 | 41.1 | 41.1 |
| | 1 | 188 | 38.3 | 38.3 | 79.4 |
| | 2 | 101 | 20.6 | 20.6 | 100.0 |
| | Total | 491 | 100.0 | 100.0 | |

AA

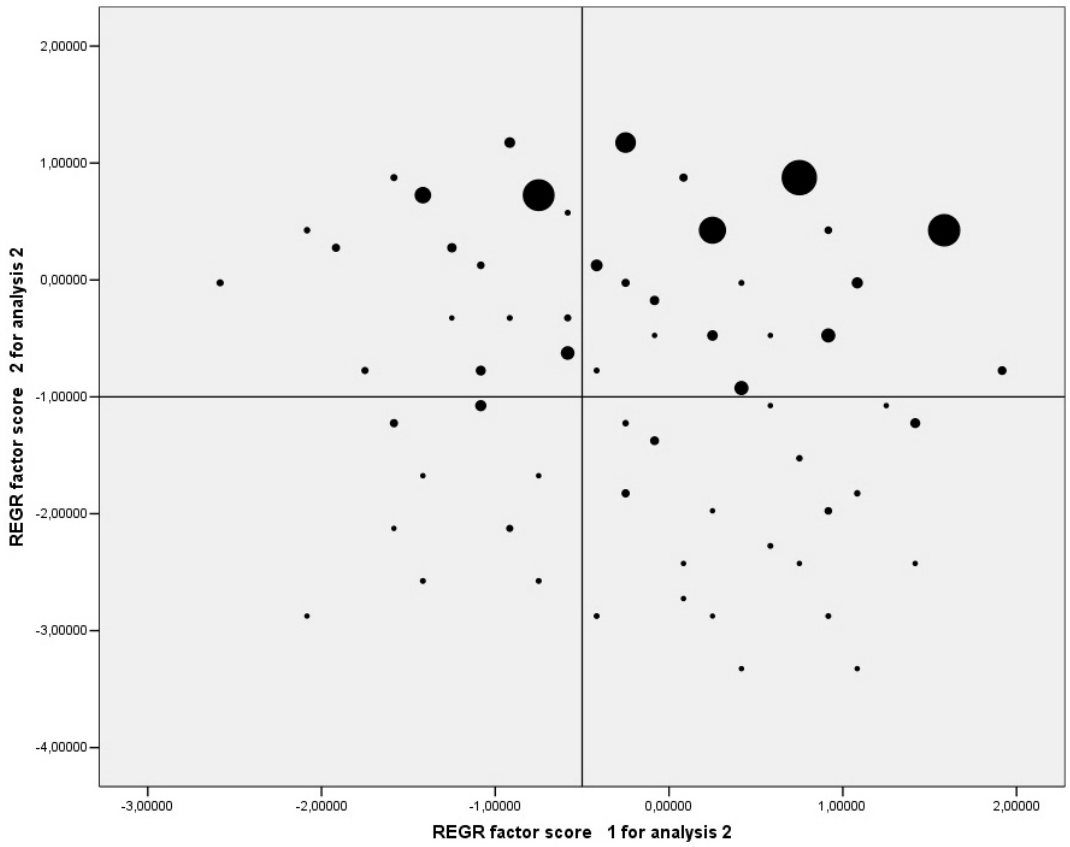
| | | Freq. | Percent | Valid Percent | Cumulat. Percent |
|---|---|---|---|---|---|
| Valid | 0 | 31 | 6.3 | 6.3 | 6.3 |
| | 1 | 115 | 23.4 | 23.4 | 29.7 |
| | 2 | 345 | 70.3 | 70.3 | 100.0 |
| | Total | 491 | 100.0 | 100.0 | |

GP

| | | Freq. | Percent | Valid Percent | Cumulat. Percent |
|---|---|---|---|---|---|
| Valid | 0 | 70 | 14.3 | 14.3 | 14.3 |
| | 1 | 213 | 43.4 | 43.4 | 57.6 |
| | 2 | 208 | 42.4 | 42.4 | 100.0 |
| | Total | 491 | 100.0 | 100.0 | |

## Appendix 2

The Profiles in the 2-Dimensional Factor Analysis



# Appendix 3

Frequency Distribution of Combinations

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 0 | 1 | .2 | .2 | .2 |
| | 1000 | 3 | .6 | .6 | .8 |
| | 1100 | 17 | 3.5 | 3.5 | 4.3 |
| | 1110 | 11 | 2.2 | 2.2 | 6.5 |
| | 1111 | 3 | .6 | .6 | 7.1 |
| | 2000 | 6 | 1.2 | 1.2 | 8.4 |
| | 2100 | 30 | 6.1 | 6.1 | 14.5 |
| | 2110 | 60 | 12.2 | 12.2 | 26.7 |
| | 2111 | 41 | 8.4 | 8.4 | 35.0 |
| | 2200 | 14 | 2.9 | 2.9 | 37.9 |
| | 2210 | 83 | 16.9 | 16.9 | 54.8 |
| | 2211 | 72 | 14.7 | 14.7 | 69.5 |
| | 2220 | 28 | 5.7 | 5.7 | 75.2 |
| | 2221 | 75 | 15.3 | 15.3 | 90.4 |
| | 2222 | 47 | 9.6 | 9.6 | 100.0 |
| | Total | 491 | 100.0 | 100.0 | |

# Appendix 4

Chi-square of Origin and on Eds

**Origin * DE Cross-tabulation**

| | | | DE | | | Total |
|---|---|---|---|---|---|---|
| | | | 0 | 1 | 2 | |
| Origin | missing | Count | 13 | 73 | 156 | 242 |
| | | % within Origin | 5.4% | 30.2% | 64.5% | 100.0% |
| | EU | Count | 15 | 45 | 115 | 175 |
| | | % within Origin | 8.6% | 25.7% | 65.7% | 100.0% |
| | LA | Count | 4 | 23 | 47 | 74 |
| | | % within Origin | 5.4% | 31.1% | 63.5% | 100.0% |
| Total | | Count | 32 | 141 | 318 | 491 |
| | | % within Origin | 6.5% | 28.7% | 64.8% | 100.0% |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 2.676(a) | 4 | 0.613 |
| Likelihood Ratio | 2.627 | 4 | 0.622 |
| N of Valid Cases | 491 | | |

a. 1 cells (11.1%) have expected count less than 5. The minimum expected count is 4.82

**Origin * AA Cross-tabulation**

| | | | AA | | | Total |
|---|---|---|---|---|---|---|
| | | | 0 | 1 | 2 | |
| Origin | missing | Count | 16 | 50 | 176 | 242 |
| | | % within Origin | 6.6% | 20.7% | 72.7% | 100.0% |
| | EU | Count | 13 | 41 | 121 | 175 |
| | | % within Origin | 7.4% | 23.4% | 69.1% | 100.0% |
| | LA | Count | 2 | 24 | 48 | 74 |
| | | % within Origin | 2.7% | 32.4% | 64.9% | 100.0% |
| Total | | Count | 31 | 115 | 345 | 491 |
| | | % within Origin | 6.3% | 23.4% | 70.3% | 100.0% |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 5.807(a) | 4 | 0.214 |
| Likelihood Ratio | 5.971 | 4 | 0.201 |
| N of Valid Cases | 491 | | |

a. 1 cells (11.1%) have expected count less than 5. The minimum expected count is 4.67

# Appendix 4 (continued)

**Origin * PK Cross-tabulation**

| | | | PK | | | Total |
|---|---|---|---|---|---|---|
| | | | 0 | 1 | 2 | |
| Origin | missing | Count | 94 | 92 | 56 | 242 |
| | | % within Origin | 38.8% | 38.0% | 23.1% | 100.0% |
| | EU | Count | 76 | 65 | 34 | 175 |
| | | % within Origin | 43.4% | 37.1% | 19.4% | 100.0% |
| | LA | Count | 32 | 31 | 11 | 74 |
| | | % within Origin | 43.2% | 41.9% | 14.9% | 100.0% |
| Total | | Count | 202 | 188 | 101 | 491 |
| | | % within Origin | 41.1% | 38.3% | 20.6% | 100.0% |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 2.987(a) | 4 | 0.560 |
| Likelihood Ratio | 3.079 | 4 | 0.545 |
| N of Valid Cases | 491 | | |

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 15.22%.

**Origin * GP Cross-tabulation**

| | | | GP | | | Total |
|---|---|---|---|---|---|---|
| | | | 0 | 1 | 2 | |
| Origin | missing | Count | 36 | 102 | 104 | 242 |
| | | % within Origin | 14.9% | 42.1% | 43.0% | 100.0% |
| | EU | Count | 24 | 78 | 73 | 175 |
| | | % within Origin | 13.7% | 44.6% | 41.7% | 100.0% |
| | LA | Count | 10 | 33 | 31 | 74 |
| | | % within Origin | 13.5% | 44.6% | 41.9% | 100.0% |
| Total | | Count | 70 | 213 | 208 | 491 |
| | | % within Origin | 14.3% | 43.4% | 42.4% | 100.0% |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | .340(a) | 4 | 0.987 |
| Likelihood Ratio | 0.340 | 4 | 0.987 |
| N of Valid Cases | 491 | | |

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.55.

# Appendix 5

Chi-square of Gender and EDs

**Gender * DE Cross-tabulation**

| | | | PE | | | Total |
|---|---|---|---|---|---|---|
| | | | 0 | 1 | 2 | |
| Gender | M | Count | 27 | 112 | 246 | 385 |
| | | % within Gender | 7.0% | 29.1% | 63.9% | 100.0% |
| | F | Count | 5 | 24 | 65 | 94 |
| | | % within Gender | 5.3% | 25.5% | 69.1% | 100.0% |
| Total | | Count* | 32 | 136 | 311 | 479 |
| | | % within Gender | 6.7% | 28.4% | 64.9% | 100.0% |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | .983(a) | 2 | 0.612 |
| Likelihood Ratio | 1.005 | 2 | 0.605 |
| N of Valid Cases | 479 | | |

a. 0 cells (.0%) have expected count less than 5.
The minimum expected count is6.28.

**Gender * AA Cross-tabulation**

| | | | AA | | | Total |
|---|---|---|---|---|---|---|
| | | | 0 | 1 | 2 | |
| Gender | M | Count | 20 | 95 | 270 | 385 |
| | | % within Gender | 5.2% | 24.7% | 70.1% | 100.0% |
| | F | Count | 10 | 20 | 64 | 94 |
| | | % within Gender | 10.6% | 21.3% | 68.1% | 100.0% |
| Total | | Count | 30 | 115 | 334 | 479 |
| | | % within Gender | 6.3% | 24.0% | 69.7% | 100.0% |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 3.983(a) | 2 | 0.136 |
| Likelihood Ratio | 3.536 | 2 | 0.171 |
| N of Valid Cases | 479 | | |

a. 0 cells (.0%) have expected count less than 5.
The minimum expected count is 5.89.

# Appendix 5 (continued)

**Gender * PK Cross-tabulation**

| | | | DC | | | Total |
|---|---|---|---|---|---|---|
| | | | 0 | 1 | 2 | |
| Gender | M | Count | 155 | 150 | 80 | 385 |
| | | % within Gender | 40.3% | 39.0% | 20.8% | 100.0% |
| | F | Count | 42 | 32 | 20 | 94 |
| | | % within Gender | 44.7% | 34.0% | 21.3% | 100.0% |
| Total | | Count | 197 | 182 | 100 | 479 |
| | | % within Gender | 41.1% | 38.0% | 20.9% | 100.0% |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | .849(a) | 2 | 0.654 |
| Likelihood Ratio | 0.855 | 2 | 0.652 |
| N of Valid Cases | 479 | | |

a. 0 cells (.0%) have expected count less than 5.
The minimum expected count is 19.62.

**Gender * GP Cross-tabulation**

| | | | AP | | | Total |
|---|---|---|---|---|---|---|
| | | | 0 | 1 | 2 | |
| Gender | M | Count | 49 | 174 | 162 | 385 |
| | | % within Gender | 12.7% | 45.2% | 42.1% | 100.0% |
| | F | Count | 19 | 34 | 41 | 94 |
| | | % within Gender | 20.2% | 36.2% | 43.6% | 100.0% |
| Total | | Count | 68 | 208 | 203 | 479 |
| | | % within Gender | 14.2% | 43.4% | 42.4% | 100.0% |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 4.441(a) | 2 | 0.109 |
| Likelihood Ratio | 4.247 | 2 | 0.120 |
| N of Valid Cases | 479 | | |

a. 0 cells (.0%) have expected count less than 5.
The minimum expected count is 13.34.

*For gender analysis the missing values are excluded.

# Appendix 6

**PE * DC Cross-tabulation**

Count

| | | DC | | | |
|---|---|---|---|---|---|
| | | 0 | 1 | 2 | Total |
| PE | 0 | 16 | 9 | 7 | 32 |
| | 1 | 58 | 56 | 27 | 141 |
| | 2 | 128 | 123 | 67 | 318 |
| Total | | 202 | 188 | 101 | 491 |

**PE * AP Cross-tabulation**

Count

| | | AP | | | |
|---|---|---|---|---|---|
| | | 0 | 1 | 2 | Total |
| PE | 0 | 10 | 17 | 5 | 32 |
| | 1 | 32 | 59 | 50 | 141 |
| | 2 | 28 | 137 | 153 | 318 |
| Total | | 70 | 213 | 208 | 491 |

**PE * AA Cross-tabulation**

Count

| | | AA | | | |
|---|---|---|---|---|---|
| | | 0 | 1 | 2 | Total |
| PE | 0 | 4 | 13 | 15 | 32 |
| | 1 | 9 | 38 | 94 | 141 |
| | 2 | 18 | 64 | 236 | 318 |
| Total | | 31 | 115 | 345 | 491 |

**DC * AA Cross-tabulation**

Count

| | | AA | | | |
|---|---|---|---|---|---|
| | | 0 | 1 | 2 | Total |
| DC | 0 | 18 | 61 | 123 | 202 |
| | 1 | 10 | 37 | 141 | 188 |
| | 2 | 3 | 17 | 81 | 101 |
| Total | | 31 | 115 | 345 | 491 |

# Appendix 6 (continued)

**DC * AP Cross-tabulation**

Count

| | | AP | | | |
|---|---|---|---|---|---|
| | | 0 | 1 | 2 | Total |
| DC | 0 | 40 | 108 | 54 | 202 |
| | 1 | 20 | 77 | 91 | 188 |
| | 2 | 10 | 28 | 63 | 101 |
| Total | | 70 | 213 | 208 | 491 |

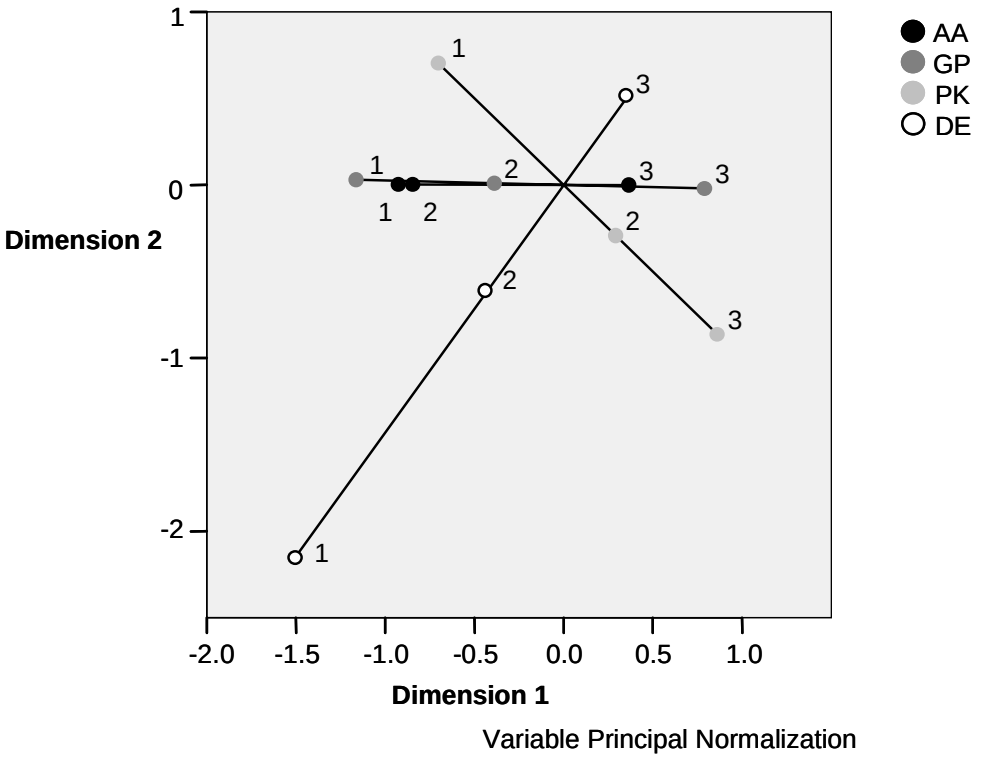
**AA * AP Cross-tabulation**

Count

| | | AP | | | |
|---|---|---|---|---|---|
| | | 0 | 1 | 2 | Total |
| AA | 0 | 6 | 14 | 11 | 31 |
| | 1 | 22 | 56 | 37 | 115 |
| | 2 | 42 | 143 | 160 | 345 |
| Total | | 70 | 213 | 208 | 491 |

## Appendix 7

Relationship DK and PE



# Appendix 8

Chi-Square Test for Independence Between Educational Dimensions

**Chi-Square Tests AA AP**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 9.076 [a] | 4 | .059 |
| Likelihood Ratio | 9.100 | 4 | .059 |
| Linear-by-Linear Association | 7.161 | 1 | .007 |
| N of Valid Cases | 491 | | |

a. 1 cell (11.1%) has expected count less than 5. The minimum expected count is 4.42.

**Chi-Square Tests AA PE**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 11.881[a] | 4 | .018 |
| Likelihood Ratio | 11.084 | 4 | .026 |
| Linear-by-Linear Association | 8.857 | 1 | .003 |
| N of Valid Cases | 491 | | |

a. 1 cell (11.1%) has expected count less than 5. The minimum expected count is 2.02.

**Chi-Square Tests AA DC**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 15.741[a] | 4 | .003 |
| Likelihood Ratio | 15.933 | 4 | .003 |
| Linear-by-Linear Association | 14.004 | 1 | .000 |
| N of Valid Cases | 491 | | |

a. 0 cells (0%) have expected count less than 5. The minimum expected count is 6.38.

# Appendix 8 (continued)

**Chi-Square Tests DE PK**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 1.826[a] | 4 | .768 |
| Likelihood Ratio | 1.877 | 4 | .758 |
| Linear-by-Linear Association | .442 | 1 | .506 |
| N of Valid Cases | 491 | | |

a. 0 cells (0%) have expected count less than 5. The minimum expected count is 6.58.

**Chi-Square Tests AP DC**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 40.944[a] | 4 | .000 |
| Likelihood Ratio | 41.799 | 4 | .000 |
| Linear-by-Linear Association | 32.959 | 1 | .000 |
| N of Valid Cases | 491 | | |

a. 0 cells (0%) have expected count less than 5. The minimum expected count is 14.40.

**Chi-Square Tests AP PE**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 30.405[a] | 4 | .000 |
| Likelihood Ratio | 30.397 | 4 | .000 |
| Linear-by-Linear Association | 27.495 | 1 | .000 |
| N of Valid Cases | 491 | | |

a. 1 cell (11.1%) has expected count less than 5. The minimum expected count is 4.56.

# Appendix 9

Principal Components Analysis

**Total Variance Explained**

| | Initial Eigenvalues | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|
| Component | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 1.486 | 37.139 | 37.139 | 1.213 | 30.332 | 30.332 |
| 2 | .972 | 24.310 | 61.449 | 1.132 | 28.309 | 58.641 |
| 3 | .893 | 22.321 | 83.770 | 1.005 | 25.129 | 83.770 |
| 4 | .649 | 16.230 | 100.000 | | | |

Extraction Method: Principal Component Analysis.

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