РОЗДІЛ 2. СПРЯМОВАНІСТЬ НАВЧАННЯ ДИСЦИПЛІН ПРИРОДНИЧО-МАТЕМАТИЧНОГО ЦИКЛУ НА РОЗВИТОК ІНТЕЛЕКТУАЛЬНИХ УМІНЬ ТА ТВОРЧИХ ЗДІБНОСТЕЙ УЧНІВ ТА СТУДЕНТІВ

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USE OF MODERN PEDAGOGICAL TOOLS OF TEACHING MATH COURSES

У статті представлений один з етапів виконання досліджень в рамках спільного україно-американського проекту по вивченню специфіки розвитку інтелектуальних умінь і творчого мислення учнів та студентів. Розглядається можливість реалізації ідей особистісно орієнтованого, активного навчання в ході вивчення математичних курсів, що передбачає поєднання традиційного навчання і навчання он-лайн з метою компенсації зменшення так званих «контактних годин». У статті детально описано спрямованість, зміст курсу, його організацію (планування, можливість комунікації, форми контролю, оцінювання виконання завдань), вимоги до знань і умінь студентів, інструменти технічної підтримки. Наведений фрагмент конкретного курсу, запропонованого студентам у 2016 році.

Ключові слова: *навчання математики; он-лайн курс; інструкція для тих, хто навчається, опис пробного курсу.*

Formulation of the problem. In modern education, the use of distance learning is spreading. There are problems with the appropriate organization of the learning process, which would allow students to acquire knowledge and skills at a high level.Introduction.

Review of prior studies. Our first goal as a teacher is to grow the intellect of students and to provide them with learning experiences that lead to good career placements. Our teaching philosophy is built around the seven requirements for effective teaching: a supportive, learner-centered environment, strong academic content, examples from the real world, active learning, assessments that adequately measure student's understanding, unique approach to each student, and professional growth [1; 2; 3; 4]. We discuss each of these requirements below.

Learner-centered environment. Learning can be made more effective when both the teacher and the students enjoy the subject and when the process is well organized.

Strong academic content. Future business leaders must think critically, logically and systematically. Therefore each of mathematic courses must have strong academic content: ideas, theories, models, and tools on which the students can build their knowledge and understanding. We must to help students develop good learning skills. Given the rapid development of science and technology, people have to be prepared to respond quickly and absorb new knowledge at any stage of their career effectively and efficiently. We have a strong desire to inspire students to explore new subjects at both theoretical and applied levels.

It is important to provide students with the motivation to study materials and the application of learning to their current and future professional life. We need to use real examples in order to encourage and motivate their students to learn for success in their future careers. For example, Kodak company uses linear programming to determine where the production of products throughout their worldwide services; marathon oil company uses

linear programming for gasoline blending and to evaluate the Economics of the new terminal and pipeline. We need to focus on the ability to use mathematics and statistics to solve real business problems and Economics.

Active learning. In lectures students often learn in a passive quality. But practice is a key aspect of learning. Students must solve problems under the guidance of teacher, using the method Socrat. The creative environment [6] in which students feel more positively, take an active part.

Assessments that adequately evaluate understanding. It is necessary to develop own assessment for measuring understanding, to create tasks which require students understanding of the concept (online tests, creative homework). The students are given homework after each section. Homework allows them to expand and deepen their knowledge and to self-evaluate their development based on their understanding of the material. This is an additional incentive for students to take an active part in each class, as well as a good indicator of their progress. The feedback received through evaluation of the home student work also allows us to improve the content of the lectures, if understanding the student does not meet the standards. Students should be encouraged to plunge deeper into the course material and the corresponding material, offering additional creative tasks, such as small projects.

A unique approach to each student. No one is identical in the way they process information. You need to find an individual approach to each student. To individualize the approach to each student, in the United States are actively using D2L and t-square. Each student can ask questions, make an appointment or receiving the requested information through D2L and t-square. To ensure that students have clear expectations for each class and give them the opportunity to stay ahead, there is a presentation of the themes and issues that will be discussed in class. The lecture PowerPoint slides for each class, homework, test exam examples always posted on D2L and web site.

Professional growth. We need to get acquainted with the latest pedagogical methods, to learn to apply different techniques to suit different audiences and different learning objectives.

Exposition of basic material. Proposed course description study of quantitative models for decision-making within business operations. Topics include univariate analysis of variance, simple and multiple linear regression, forecasting, linear programming, optimization models, analysis and solution. Case studies are used to illustrate the application of simulation in business settings and program tables is used to assist in modeling and analysis. We offer an example of the course.

Course Objectives. To introduce and demonstrate the use of several quantitative models in decision making:

1. Study how to formulate models for problems and solve them using linear programming (LP) to get to the optimal/best solution.
2. Learn to apply LP to different problem areas for e.g. transportation industry, manufacturing, dietary applications, marketing, service industries etc.
3. Use Integer programming for real world problems that require integer solutions only.
4. Learn to use ANOVA for making inferences about more than two population means.
5. Use Linear Regression to find out relationship between two or more variables.
6. Use Forecasting to predict future both in the short and medium time frame and then use this information to make decisions in the present that will ensure continued success of a firm.
7. Discuss how to arrive at final decisions for problems which are not deterministic but have lot of uncertainty or even probability attached to future events.

Technical Requirements. Internet Explorer or Mozilla Firefox Internet Browser; Java (the version recommended by D2L); Broadband Internet Access (i.e. DSL, Cable, ISDN).

Technical Skills. Basic proficiency in MS Excel and Word is required.

Technologies Used. Microsoft Word, Excel, PowerPoint, Blackboard Collaborate, Mediaspace/Kaltura, YouTube videos; Calculator; access to Excel (available in all KSU computer lab rooms).

Accessibility Statements for Technologies. Microsoft Office Suite; YouTube

Privacy Policy for External Tools. YouTube.

Other essentials. Calculator; access to Excel (available in all KSU computer lab rooms).

Tutoring in BB-292. Visit the Tutoring Center website for current semester schedule.

Communication. E-mail via D2L is the best way to request information. Students should check D2L regularly, as course changes will always be announced and recorded on the course D2L.

Test policy. Three tests and final exams must be taken on the dates listed in the schedule. Last submission will not be accepted.

Extra credit will be awarded to students actively participating in discussions and helping their fellow students with their questions.

Distribution of points:	
Quizzes	100 points (5*20=100)
Exam I-III	300 points (3*100=300)
Final Exam	120 points
Self-introduction essay	10 points
Total	530 points

A: 477 and above; **B**: 424-476; **C**: 371-423; **D**: 318-370; **F**: 317 and below.

Relationship between average test score (with any fractional average rounded up) and letter grade: 90-100 = A, 80-89.9 = B, 70-79.9 = C, 60-69.9 = D, below 60 = F.

Discussion areas and a Forum. Discussion areas for materials covered in every topic are provided in D2L for students to post any questions students has about the material covered in the week. Teacher will respond to any questions posted in these discussion areas by the end of the following weekday unless students are otherwise notified. Extra credit will be awarded to students actively participating in discussions and helping their fellow students with their questions. Discussions are designed for students to post legitimate questions, should always follow the communication etiquette (discussed later) and should not be used to vent. Any post that does not match this criterion will be deleted. Detailed overview on the same can be found at the Netiquette Home Page.

Study guidelines (for students)

1. Work with the posted materials for the week. Read the Text Book very carefully for every new topic. Make notes of the topics you understand and post any unanswered questions you have in the appropriate discussion area; you are probably not the only one with those questions. All the questions will most likely be answered before the start of the next week. Contact me for help.
2. Try to answer questions that your fellow classmates have. This not only builds your confidence but also makes you look at things more intuitively.
3. Complete all assessment on time. Timely work is the key to success in this course.
4. Basic proficiency with Microsoft Excel is assumed in this class. If you are not familiar or comfortable with it, you need to obtain the textbook used in BISM 2100 or another Excel Tutorial and spend some time in the lab learning the software immediately.
5. This course will equip you with new tools and techniques that you can use anywhere you work. Enjoy it and have fun!

Tentative Course Outline (for example)

Date	Topics, all related materials on D2L and short plan for learning	Associated Chapter(s) to Read in Text
	Module 1 "Statistics"	
WEEK 1 **Aug 15- Aug 21**	Review all materials in the Folder Start Here. Write and download on D2L your introduction essay (self-introduction discussion board). Introduction to Probability.	Read a Text book, Ch.11 (D2L)
WEEK 2 **Aug 22- Aug 28**	**Topic 1. Performing a one-way ANOVA to compare multiple population means.** Folder "Module 1" / "ANOVA" 1. Watch videos: ANOVA Analysis Basics How to calculate ANOVA with Excel ANOVA with Excel 2016 Data Analysis Tools 2. Review: ANOVA Problems, ANOVA Solving Problems.xls, ANOVA Solving Problems Details Folder Practice Assessments/ Practice Quizzes / Practice Quiz 1 3.Review Practice Quiz 1 and all materials in this folder. Folder Excel Tutorials 4.ANOVA-Excel Tutorial	Text (ECON 2300 text book): Essentials of Statistics for Business and Economics, 6th Edition Revised, by Anderson, Sweeney and Williams chapter 10 Sections 10.4-10.5 (D2L)
	Quiz 1 (ch.10) Aug 25, 2016 8:00 AM – Aug 28, 2016 11:00 PM *(for example)*	Quiz 1 will cover chapter 10, Supporting materials in the folder "Practice Quizzes" / "Practice Quiz 1"

Module 1 "Statistics"

WEEK 1 Topic: Introduction of course. Review of Syllabus

1. Print a copy of the syllabus and read syllabus carefully.
2. Read Welcome Letter.
3. Look at the Instructor Introduction Presentation.
4. Look at the **Course Overview** Presentation.
5. View the Intro to Online Learning presentation.
6. Read the information posted in the links under **Student Support.**
7. Review ch.11 of text book "Probability and Statistics".
8. Write your self-introduction and download it on D2L using self-introduction discussion board. Due day is **August 21, 11:00 pm** *(for example).*

WEEK 2 Topic: Performing a one-way ANOVA to compare multiple population means. Quiz 1

1. Print out the Learning Objectives for Module 1 "Statistics" from Syllabus p.__.

Folder "Module 1" / "ANOVA"

2. Watch videos: ANOVA Analysis Basics, How to calculate ANOVA with Excel, ANOVA with Excel 2016 Data Analysis Tools
3. Review: ANOVA Problems, ANOVA Solving Problems.xls, ANOVA Solving Problems

Details. Read all materials posted in the folder "ANOVA".

Folder Practice Assessments/ Practice Quizzes / Practice Quiz 1

4. Review Practice Quiz 1 (folder "Practice Assessments"/ "Practice Quizzes" / "Practice Quiz 1") and all materials in this folder.

Folder Excel Tutorials

5. Review: ANOVA-Excel Tutorial
6. Take Quiz 1 (folder "Module 1"/ "ANOVA". Quiz 1 schedule is _.

At the end of this course, the student will be able to:

Learning Objectives for Module 1

1. With respect to a one-way ANOVA:
   (a) identify its assumptions
   (b) test (using the p-value approach) the null hypothesis that all the population means are equal
   (c) obtain and interpret in the context of the problem a Bonferroni family of confidence intervals for the difference between each pair of population means.
1. With respect to regression analysis:
2. With respect to the (classical normal) linear regression model:
   (a) express (symbolically) the model
   (b) inspect the model assumptions
   (c) distinguish between the population regression equation and sample regression equation.
3. Formulate the corresponding regression model and indicate (where possible) the signs of the model coefficients for given a verbal description of a person's belief about the relationship between a dependent variable and a set of independent variables
4. For a particular regression model specification and relevant sample data:
   (a) use Excel to perform an ordinary least squares regression analysis
   (b) develop the sample regression equation
   (c) interpret (in the context of the problem) the standard error of the estimate
   (d) analyze which model assumptions appear to be met based upon the residual plots (in the Excel output)
   (e) illustrate what each of SST, SSR, and SSE represent in the context of the problem
   (f) identify in the Excel output and interpret in the context of the problem r^2
   (g) test for the significance of the overall model, and test for the significance of each individual coefficient
   (h) interpret a point estimate for the mean value of the dependent variable across all entities having specified values for the independent variables
   (i) demonstrate a point estimate for the value of the dependent variable for a single entity having specified values for the independent variables
   (j) interpret the sample regression coefficients in the context of the problem
5. Analyze if model has a multicollinearity problem and omitted variables bias, and identify a drawback associated with each.

Course Description (for students): This Excel-based course covers the statistical methods for solving problems encountered in the functional areas of business. During the semester, you will learn and apply statistical concepts that are most important for the practical analysis of management decisions from a variety of areas: finance, banking, marketing, advertising, operations, real estate, accounting, and human resource. Cases studies based on realistic business situation with real data and software tools will be used extensively throughout the course to relate the concepts and methods to business environments. E-learning & assessment online system is used in this course. The course is divided into three modules: Variation, Probability and Inference. The first module "Variation" introduces the basic terminology, summary statistics, and graphical summaries. The second module "Probability" presents the concept of a random variable (idealized description of the data in

applications). The third module "Inference" covers statistical inference (the process of inferring properties of an entire population from those of a subset known as a sample. The fourth module "Regression" introduces linear regression models (an important tool in business for assessing profitability, setting prices, identifying anomalies, and generating forecasts).

Course Goals:

1. Provide the students with a sound conceptual understanding of role of statistics in decision making.
2. Teach the students basic statistical analysis techniques.
3. Provide background on the use of data and statistical methods for business management.

Final grade will be assessed as follows:

Assignment	**Points**
Homework I- IV	20*4
Quiz 1-8	10*8
Test 1-4	100*4
Final	150
Attendance&Participation	50
Total	**760**

The target assignment for letter grades will be as follows:

A – 684 points and above;
B – 608 - 683 points;
C – **532 - 607** points;
D – **456 - 531** points;
F – 455 points and below

Relationship between average test score (with any fractional average rounded up) and letter grade: 90-100%= A, 80-89.9% = B, 70-79.9% = C, 60-69.9% = D, below 60% = F.

Quizzes. There are eight (8) is evaluated during the semester. They cost 80 points. Quiz posted on the website MyStaLab.com. They have limited time 30-50 minutes. There are two attempts on each test. The repeated attempts are final. All tests are open notes and open and individual effort. Surveys can help to focus on understanding of key concepts/tools, and how to implement statistical procedures in Excel.

Final Exam (Test 5). Final exam is cumulative exam. Final Exam is closed-book and individual efforts. Students must bring your laptop with MyStatLab and Excel for the Final Test. Students may bring 2 index cards (both sides) as a formula sheet to the Final Test.

Learning Objectives. By the end of this course, the student will be able to (with access to Excel or any needed statistical table presumed throughout):

1. Distinguish between, and both recognize and provide examples of:
   (a) populations and samples
   (b) parameters and statistics
   (c) descriptive statistics and inferential statistics
   (d) qualitative and quantitative variables/data
   (e) cross-sectional data and time series data
   (f) variables/data measured on the nominal, ordinal, interval ,and ratio scales
2. Identify what each of the following symbols represents, and recognize each symbol's referent in a verbal passage: N, n, p, $\bar{p}$, μ, σ^2, σ, $\bar{x}$, s^2, s
3. Summarize a set of observations of a qualitative variable by:
   (a) constructing a frequency or relative frequency or percentage (percent frequency) distribution; and
   (b) portraying the distribution in the form of a bar chart or Pareto diagram or pie chart
4. Summarize a set of observations of a quantitative variable by:

(a) constructing a boxplot and combine boxplot with histograms
(b) if the observations are time-series data, constructing a line graph
(c) constructing a frequency or relative frequency or percentage (percent frequency) distribution, portraying the distribution in the form of a histogram, and describing the shape of the distribution
(d) assessing which (if any) of the mean and median better represents the set
(e) determining the mean, median, mode, range, interquartile range, variance, standard deviation, and coefficient of variation
(f) determining requested percentiles and providing the five number (minimum, first quartile, median, third quartile, maximum) summary
(g) identifying outliers (if any)

5. Apply the Empirical Rule to describe a set of quantitative observations having a bell-shaped (i.e., approximately normal) distribution
6. With respect to probability concepts and rules:
   (a) distinguish between the classical, relative frequency, and subjective methods of assigning probabilities to events
   (b) define what it means for two events to be independent, and verify whether or not two events are independent
   (c) define what it means for two events to be mutually exclusive
   (d) apply basic probability rules to calculate probabilities
   (e) apply concept of conditional probability to calculate probabilities
7. Determine the expected value (mean), variance, and standard deviation of a discrete random variable from its probability distribution.
8. Recognize—and provide three—basic characteristics true of all normal distributions.
9. Answer a probability question about a variable having a particular normal distribution, and determine the value of a normally distributed variable corresponding to a desired percentile.
10. Suggest four reasons why, to obtain information about a populations, one might draw a sample from the population rather than examine the entire population.
11. Define a simple random sample of size n drawn without replacement from a finite population.
12. With respect to sampling distributions:
    (a) state the Central Limit Theorem
    (b) provide an illustration of the Central Limit Theorem in the form of a graph of one population distribution and graphs of three associated sampling distributions of the mean
    (c) given the mean and standard deviation of a population, describe the distribution of the sample mean when the population is approximately normally distributed or a large sample size is operative
    (d) given the proportion of a population falling in a particular category, describe the distribution of the sample proportion when a large sample size is operative
13. Define what is meant by a C% confidence interval for a population parameter.
14. Recognize—and provide three—basic characteristics true of all t-distributions having more than 2 degrees of freedom.
15. Given sample data or measures, obtain and then interpret (using words, not symbols) in the context of the problem:
    (a) a two-sided or one-sided confidence interval for a population mean
    (b) a two-sided or one-sided confidence interval for a population proportion
    (c) a two-sided confidence interval—based on independent samples—for the difference between two population means when the populations' standard deviations are unknown

(d) a two-sided confidence interval—based on matched samples— for the difference between two population means
(e) a two-sided confidence interval for the difference between two population proportions

16. Estimate how many entities should be sampled to obtain a two-sided confidence interval-for a mean or proportion-having a given level of confidence and a given margin of error
17. Given sample data or measures, using the p-value approach, and stating (using words, not symbols) the conclusion in the context of the problem:
    (a) test a hypothesis about a population mean
    (b) test a hypothesis about a population proportion
    (c) test a hypothesis—based on independent samples— about the difference between two population means when the populations' standard deviations are unknown
    (d) test a hypothesis—based on matched samples— about the difference between two population means
    (e) test a hypothesis about the difference between two population proportions
18. In the context of hypothesis testing:
    (a) distinguish between the significance level α and the p-value p
    (b) given the p-value, determine whether the null hypothesis would be rejected at a given significance level α
19. Distinguish, in the context of hypothesis testing, between a Type I error and Type II error, and, for a particular null hypothesis, suggest one negative consequence of making a Type I error and one negative consequence of making a Type II error.
20. With respect to the covariance and the correlation coefficient:
    (a) describe what each measures
    (b) calculate each measure given a sample or finite population of (x,y) data points
    (c) interpret a given correlation coefficient
    (d) describe the relationship between variables X and Y suggested in a scatter diagram of (x,y) data points
21. Perform a chi-square test of independence.
22. With respect to regression analysis:
    1) With respect to the (classical normal) linear regression model:
       (a) express (symbolically) the model
       (b) inspect the model assumptions
       (c) distinguish between the population regression equation and sample regression equation.
    2) Formulate the corresponding regression model and indicate (where possible) the signs of the model coefficients for given a verbal description of a person's belief about the relationship between a dependent variable and a set of independent variables
    3) For a particular regression model specification and relevant sample data:
       (a) use Excel to perform an ordinary least squares regression analysis
       (b) develop the sample regression equation
       (c) interpret (in the context of the problem) the standard error of the estimate
       (d) analyze which model assumptions appear to be met based upon the residual plots (in the Excel output)
       (e) identify in the Excel output and interpret in the context of the problem r2
       (f) interpret a point estimate for the mean value of the dependent variable across all entities having specified values for the independent variables
       (g) demonstrate a point estimate for the value of the dependent variable for a single entity having specified values for the independent variables
       (h) interpret the sample regression coefficients in the context of the problem
23. Use Excel to:

(a) graphically portray a frequency, relative frequency, or percentage (percent frequency) distribution that already exists in the form of a table as a histogram (if dealing with quantitative data) or as a bar chart or pie chart (if dealing with qualitative data)

(b) construct side-by-side bar charts corresponding to two or more given tabular distributions

(c) construct from an unsummarized set of observations a frequency, relative frequency, or percentage distribution by relying on the =COUNTIF function

(d) portray time-series data in a line graph

(e) construct a cross-tabulation for given observations of two variables relying on the PivotTable module

(f) determine the mean, median, mode, range, variance, and standard deviation of a set of quantitative observations both by relying on the appropriate Excel statistical functions and on the Descriptive Statistics tool

(g) apply where appropriate the =NORMDIST and =NORMINV functions to address questions about a normally distributed variable

(h) apply where appropriate the following tools: t-Test: Two-Sample Assuming Unequal Variances; t-Test: Paired Two Sample for Means

(i) construct a scatter diagram of a set of (x,y) data points and superimpose upon it the best-fitting line

(j) given a sample or population of (x,y) data points, determine the corresponding covariance and correlation coefficient by relying on the appropriate Excel statistical functions

(k) perform regression analysis with Excel Data Analysis tools.

Results and Discussion. The use of trial course was shown by the increase of cognitive activity of students, to their responsibility for the results of teaching.

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Рудченко Т., Чашечникова О. Использование современных педагогических инструментов преподавания математических курсов.

В статье представлен один из этапов выполнения исследований в рамках общего украино-американского проекта по изучению специфики развития интеллектуальных умений и творческого мышления учеников и студентов. Рассматривается возможность реализации идей личностно ориентированного, активного обучения в ходе изучения математических курсов, предусматривающего совмещение традиционного обучения и обучения он-лайн с целью компенсации уменьшения так называемых «контактных часов». В статье детально описано направленность, содержание курса, его организацию (планирование, возможность коммуникации, формы контроля, оценивание выполнения заданий), требования к знаниям и умениям студентов, инструменты технической піддержки. Приведен фрагмент конкретного курса, предложенного студентам в 2016 году.

Ключевые слова: *обучение математике; он-лайн курс; инструкция обучающимся, описание пробного курса.*

Rudchenko T., Chashechnikova O. Modern Pedagogical Tools of Teaching Math Courses.

There is showed the one step of joint Ukrainian - American research to study specification students' intellectual skills' development and their development of creative though. It's considered the possibilities to realize ideas about personalizing and actively study mathematics. This ideas are provide d for combine tradition and on-line study. The main target such compensation is to reduce the "contact time". Its detaily described the courses' orientation, its contents and organization (planning, communication, monitoring, evaluation of assignments), the requirements for knowledge and skills of students, technical support in this article. It's given a part of a specific course offered to students in 2016.

Key words: *mathematics education; on-line course, Study guidelines, Tentative Course Outline.*

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РЕАЛІЗАЦІЯ ІДЕЙ РОЗВИВАЛЬНОГО НАВЧАННЯ НА УРОКАХ МАТЕМАТИКИ: АВТОРСЬКИЙ ДОСВІД

У статті розглядається проблема ефективної реалізації ідей розвивального навчання математики. Автором проаналізовано основні шляхи упровадження розвивального навчання математики у сучасній школі, виявлено основні вимоги до організації пізнавального процесу в умовах розвивального навчання. Представлено авторський досвід організації розвивального навчання на уроках математики в різних класах у Барській загальноосвітній школі. Наводяться приклади фрагментів уроків з математики, ігрових ситуацій, специфічних навчальних завдань, спрямованих на розвиток важливих компетентностей учня в процесі навчання математики.

Ключові слова: *розвивальне навчання, навчання математики, ігрові ситуації на уроці, веб-квести, математична газета.*

Постановка проблеми. Згідно закону України «Про освіту» метою освіти є всебічний розвиток людини як особистості та найвищої цінності суспільства, розвиток її талантів, розумових і фізичних здібностей, виховання високих моральних якостей, формування громадян, здатних до свідомого суспільного вибору, збагачення на цій