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Selecting Software Tools for Learning Organizations Based on Fuzzy Logic Model

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Abstract:- Customer Satisfaction becomes one of the drivers of business development. It is obviously one of those areas with high uncertainty. Lifelong learning business requires the highest level of customer loyalty. In this article the author shares his experience of implementing special technical tools (Office 365: Teams, Onedrive, Stream) for improving virtual learning services. Fuzzy logic helps the author to identify demand, requirements, constraints and assumptions for each educational product.

Keywords:- *Customer Satisfaction, Fuzzy Logic, Lifelong Learning.*

I. INTRODUCTION

Customer Satisfaction becomes one of the drivers of business development. Although the term "customer satisfaction" becomes rather common, we consider various decomposed factors and metrics as its indicators. The author deals a lot with implementing fuzzy-based models [1] for analyzing systems with high level of uncertainty [2-4]. Customer satisfaction is obviously one of those areas with high uncertainty. This article implements the author's experience of implementing special technical tools (Office 365: Teams, Onedrive, Stream) for improving virtual learning services.

The author's experience deals with the implementing of various synchronous and asynchronous virtual and blended learning methods for professional lifelong learning services. In this article we represent and analyze software tools selection process for the following learning methods:

- «inclass» webinars, the term describes the simultaneous learning for students attending class in person and on-line [5];
- «open classes», the term describes a blended training method, at which students study at class and online different courses under supervision of a teacher/professor. Each student studies training content using individual video, executes practice cases, and a teacher/professor delivers individual consulting for students;
- half self-paced learning, the term describes the training method, at which a teacher/professor delivers short sessions in class and on-line. After each session students study training content individually aside the class. The next session contains Q&A session, lab/practice evaluation, and etc.
- pure on-line synchronous learning, or webinars;
- micro-courses in the asynchronous mode; and
- asynchronous off-line studies.

The author implemented the mentioned types of learning both as a learning organizer, and as a professor. As a learning organizer in a role of a portfolio manager the author provided various research to define learning methods objectives, methodology, administrative and technical facilities.

In this article we describe and analyze the most recent experience of implementing Microsoft Office 365 product family for the listed training methods in various learning organizations.

The goal of the research is to find out dependencies and impact of technical tools and their methodological opportunities on students learning progress and satisfaction.

II. METHODOLOGY

1. Students and teachers' surveys, and their analysis based on statistics, mind mapping, and decision trees.
2. Methodology opportunities analysis based on fuzzy logic tools [6-8].
3. Technical tools descriptions and manuals analysis.

Two critical success factors are:

- learning organization effectiveness and efficiency
- students professional improvement and satisfaction.

Let's decompose both CSFs to find common items.

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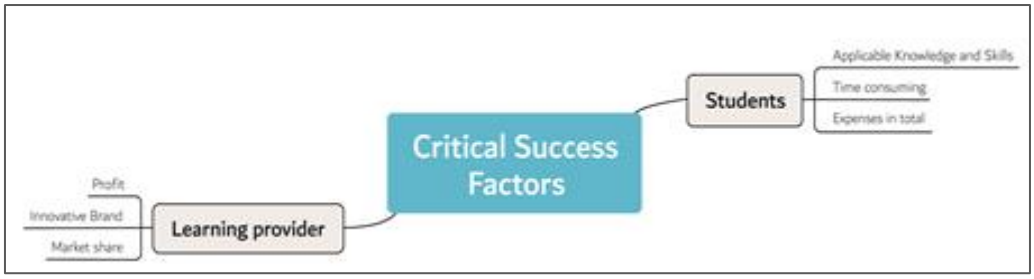

Fig 1

As mentioned in (see also – links to articles fuzzy research), student's progress and satisfaction strongly depends on various factors, including personal preferences, such as:

- spare time
- willingness to learn
- time limits and hard deadlines,
- psychological specific features: introvert, shy, and others.

Learning organization efficiency on the other hand depends on student's satisfaction and their willingness for continuous learning, and capabilities to deliver learning services cheap, and adapt them to changes in the fast manner with minimal expenses and service disruption.

III. PREPARE YOUR PAPER BEFORE STYLING

In our fuzzy models we assign weights for, which characterize a software tools alignment across demands, requirements, and constraints, mentioned above (excerpt from the survey is in Amendment 1). As those parameters' weights are different, i.e. currency, subjective estimates, binary, we introduce an expert based rating from 1 to 5 to weight the components. In this scale 1 means the lowest level of satisfaction, and 5 – the highest one.

We calculated rating based on expert's estimates with standard deviation of 3/4 sigma (3-point estimation in case we had 5 expert estimates or less, and PERT estimating in other cases) [9].

A. *Who are «the experts»:*

- customers (students) for satisfaction attributes. Their estimating is expressed in after course evaluation feedback forms;
- trainers (teachers)
- technical and administrative staff. The expert opinion is gathered by special free feedback forms;
- Learning organization as a business unit. The weights are estimated based on top stakeholder opinion, and company internal documents, e.g. vision, strategy, policies.

B. Developing the fuzzy model of customer satisfaction in an educational organization.

Based on a fuzzy model, which is described in [2], we performed a new iteration of analysis of demand, requirements, methodological, organizational, and technical facilities [10].

The following components below are repeatable and gave the highest ranking. We assign a certain fuzzy variable to estimate each component.

Satisfaction attributes:

- price (mark this attribute with a fuzzy variable named P)
- personalized approach (PA)
- mobility (MB)
- actual content (AC)

Learning organization efficiency attributes:

- software with all-in-one features (SF)
- stable supported by a specialized vendor (SV)
- cheap (CH)
- mobile (MB)
- video recording (VR)
- video player (VP)
- synchronous and asynchronous communications (CM)
- content sharing and many-to-many exchange (SH)
- role authorization (RA)
- localized (LC)

Fuzzy model represents adequate description, because it provides attributes presentation based on a natural language. For example,

Term «simple» includes:

- interface is intuitive (II)
- estimating price as a «cheap» using fuzzy linguistic variable (as shown at fig. 3) (CH)
- a user can install (load an app) himself; (USI)

Simplified fuzzy model for student's expectations and satisfaction looks as the following:

$$MS = P \rightarrow CH \cup PA \cup MB \cup AC \quad (1)$$

Simplified fuzzy model for the learning organization effectiveness and efficiency can be represented as the following:

$$LO = SF \cup SV \cup CH \cup MB \cup VR \cup VP \cup CM \cup SH \cup RA \cup LC \quad (2)$$

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IV. ESTIMATING APPLICABLE SOFTWARE TOOLS FOR FUZZY MODELS

Let's estimate Microsoft O365 service based on the models above.

First, let us give a brief overview of tools, we implemented and assign them fuzzy variables:

- Teams as the main synchronous and asynchronous communication tool, and also recording tool, content delivery and students evaluation tool [11] – name it as TCT fuzzy variable
- Onedrive as file storage - ODFS
- Stream as video service - SVS
- Powerpoint as a reserve video recording tool - PPRT

Let's create an estimate for the mentioned features across fuzzy model components.

We can include TCT attribute into the following components, and assign its weight across each component:
TCT (P) (i.e. cheap for a student): 5 points (students pay nothing, and can work either from browser, or desktop, or mobile app)

TCT (CH) for a learning organization: 3 to 4 points because technical support is necessary, and the company pays for participation in Microsoft partner program. So, we can represent the graphic for TCT as shown on Fig.
TCT(SV) is weighted between 2 and 4
TCT (CM) is weighted as 4-5

TCT (II) estimates are between 2 and 4, with maximum at 3. The highest grades are for localized user interface, while the complicated UI with a lot of elements is factor of dissatisfaction.

The simplified graphical representation based on the first three inclusions is st the fig.

All other estimates for TCT component against other model components, as well as estimates of other implemented tools is performed in a similar way.

The author implemented the same model for another tool: GotoMeeting [2,3,5]. This tool had been implemented. Let us give a comparative analysis on an example if the same factors, as shown above gor Teams.
TCT (P) = 5 as free for end-users (students)
TCT (CH) = 3-4 due to annual basic pricing and monthly invoicing based on capacity consumed.
TCT (SV) = 3-4
TCT (CM) = 2-4 with maximum close to 2, because omly synchronous communications are delivered,
TCT (II) = 3-4, the high grade is for very simple UI, while low grades are for non-localized UI.

The model shows, for example, that GoToMeeting has advantages for synchronous learning, while Teams is «a broadband tool», and has advantages for learning organizations, which implement either blended/asynchronous methods, or wide spectrum of learning methods.

V. PRACTICAL IMPLEMENTATION IN EDUCATIONAL ORGANIZATIONS

While working on this article the author applied the described model in three educational organizations, which deliver different types of trainings, and pursue different goals. They are:

- Business school, which delivers long-term programs for BBA, MSc., and MBA studies
- Training organization of professional adult's lifelong learning, which delivers short-term courses, and based on them combined programs of additional professional trainings, and second profession.
- On-line learning platform.

The three types of students were involved:

- long-term traditional education: bachelor and master programs with duration of studies from 1 to 3 years,
- short-term students, usually mature professionals, which improve their professional skills and competences, and get additional diplomas or certificates
- short-term students, which usually eager to learn a certain local skills area, or consider a course as a kind of knowledgebase.

VI. CONCLUSION

The author tested the model on two tools for three types of students, and five learning methods. The model can be either simplified by implementing less parameters and estimate factors or make more complicated to provide more precise predictions. The productivity of the model depends exponentially or factorial on number of parameters and factors.

The author is eager to continue working on this model both for testing and adapting it to other tools and services, and model improvement as well.

The author appreciates greatly suggestions for improvement, questions, and criticism.

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