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mwlubna@hotmail.com⁴Department of Statistics, The Islamia University of Bahawalpur**ARTICLE DETAILS****History**

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ABSTRACT

Quality Function Deployment (QFD) is a meticulous procedure of translating consumers' needs and demands into appropriate solutions. The application of QFD has been expanded, leaving no definite boundary for its potential use, to almost every field of life. It helps identify not only the needs and demands of a certain matter but also helps find out the solutions of those matters along with assigning them the priorities. Primary education enjoys the fundamental role and provides the foundation for further upbringing of children with respect to their educational, social, intellectual, cultural, emotional and physical proficiencies. This research article is aimed at exploring the Voices of Parents, (VOPs) (parent's needs and demands) regarding their children's educational requirements at primary school level. This objective is achieved by identifying significant VOPs and then converting these into Technical Solution for better and high quality of education. With the help of QFD methodology, a real-life case study has been conducted to identify VOPS their technical solutions, then the order of these technical solutions is determined and, finally, suggestions are made about which technical solution is the most important and which one is the least. The findings provide a guide line for primary school stakeholder to identify problems and their solutions for better standard and quality of education.



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Corresponding author's email address: mwlubna@hotmail.com

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1. Introduction

Education is universally believed as a factor that plays a vital role in the success of a person at individual level and of a society on the whole. Education enlightens person's thinking and mind. Every society establishes an education system that possibly ensures the imparting of education to its each and every member.

The education system in Pakistan is basically classified into six levels- preschool for the age from 3 to 4 years, primary covers grades one through five for the age group of 5 to 9 years, middle comprising of grades six

through eight meant for children of ages from 10 to 12 years, secondary that includes grades nine through twelve for the children from 13 to 16 age group and, afterwards university education leading to undergraduate and graduate degrees, and finally M.Phil, and Ph.D degrees (Pakistan Academy of Educational Planning, 2018). Every level of education has its own importance but primary education holds a vital position because it provides a foundation upon which the building of higher learning is to be raised.

This article explores various problems at primary level in private sector schools, also systematically finds their technical solutions, and, then, developing new mathematical and statistical heuristics. In this article our focus is primary education in private schools. We are focusing the Voices of Parents (VOPs) and finding their problems in private schools. Here, VOPs means parents' needs and demands regarding their children's education. Quality Function Deployment (QFD) is used as research procedure to conduct this study.

In next section, some literature review about how QFD has been employed in the field of education is discussed.

2. Literature Review

The methodology of Quality Function Deployment (QFD) analyses the problems of customers/users and provides a systematic approach of discerning the corresponding viable and technical solutions. The main objective of QFD is to improve the quality of a product with less time and effort. Practitioners and researchers have also employed QFD to improve the quality of learning in institutions, quality of syllabi, course design, higher education, etc. For example, Moura E SÀ and Saraiva (2001), through concept engineering and QFD techniques, explored the concept of ideal kindergarten by collecting and analyzing the needs and perception of customers (children, teachers and parents) and determined an ideal customer-oriented kindergarten concept.

Duffuaa et al. (2003) aimed at customizing the methodology of QFD for planning a basic course of statistics in the Department of Systems Engineering and found that the quality of educational programs was extremely influenced by the design and delivery of the courses. Sahney et al. (2004) conducted a study to draw up views of students of selected educational institutes about the quality of those institutions and, then, by using QFD outlined the "minimum design characteristics/quality components that meet the requirements of student as customers of the educational system" (P.143).

Another study based on QFD conducted by Ahmed (2006) explicitly for KIMEP (Kazakhstan Institute of Economics, Management and Strategic Research) to translate Voices of Customer (students) into program requirements, i.e., the needs and requirement of students were identified that provided the foundation in delivering quality curriculum and services in higher education.

Raharjo et al. (2007) applied a method to progress higher education quality using QFD and Analytical Hierarchy Process (AHP). In their research work, they described that for formulating a powerful deliberate strategy in a customer-driven learning framework, it is essential to know who the consumers are and what their necessities are. For translating this information into strategies and achieving customers' satisfaction they used QFD methodology.

Mohsin, Padró, & Trimmer (2018) used QFD to identify the areas that needed improvement to meet the personal needs and professional expectations of the international students enrolled in an Australian higher education institution, and to align these with institutional requirements (IR).

3. Objectives

- a) To explore the Voices of Parents, (VOPs) (parent's needs and demands) regarding their children's educational requirements at primary school level.
- b) To determine the Solution of each Voice of Parents (SVOP) or technical solutions (TSS) in the meetings with teachers, head of schools, owners of schools and educational experts.
- c) To determine the order of these technical solutions by ranking through a procedure.
- d) To make suggestions which technical solution is the most important and which one is the least.

4. Methodology

The Quality Function Deployment (QFD) is a procedure that is used to improve systems, processes, products, services, etc. The QFD, first, systematically explores problems and then integrates their corresponding solutions. QFD has wider application and has been extensively used for transforming qualitative factors into quantitative production necessities (Tidwell and Sutterfield, 2012).

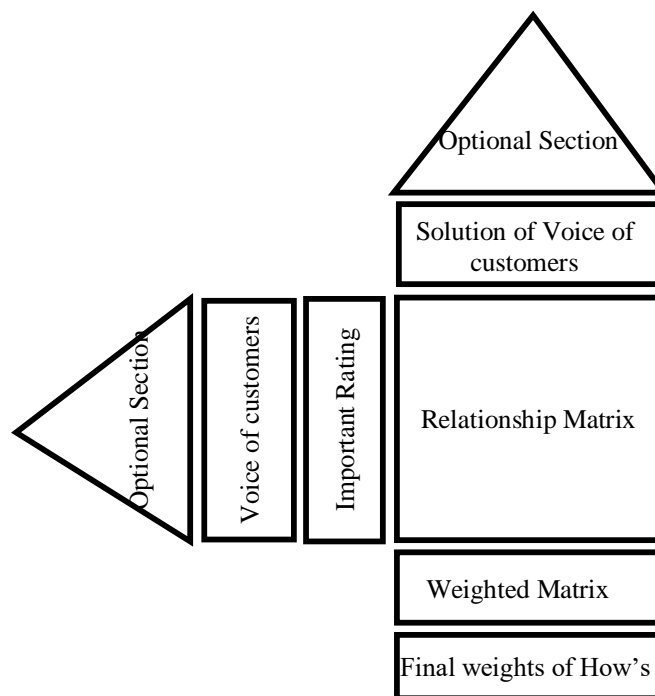
In this section, we have briefly described the major sections of QFD; and have also illustrated how each QFD section helps achieve our objectives of this article.

The population of this study is the private primary schools of Bahawalpur city, which is 287 in number. The teachers, parents of these schools are also the stakeholders. The sample of study is based on convenience sampling technique for a sample size of 500. Questionnaire as data collection tool is used to fulfill the requirement of various sections of QFD.

4.3. Quality Function Deployment (QFD) and House of Quality (HOQ)

The QFD methodology leads the practitioners in establishing a House of Quality (HOQ) that suggests the characteristics of products and services in accordance with the customers' needs and aspirations. This HOQ includes various sections that are sequentially and systematically based on qualitative-quantitative information provided by the respondents (customers), technical experts and competitors. Figure 1 describes different sections of the QFD-HOQ. ty Islamabad, Pakistan.

Figure 1. Various sections of the QFD-HOQ



In the coming paragraphs, we have described the role and importance of sections of the QFD-HOQ as shown in figure1; and then elaborated the procedure of this study based on this discussion.

4.2. Voice of Customers (VOCs) Section

The first important section of HOQ under the framework of QFD that contains real requisites and demands of customers, their importance ratings along with the correlations between them is usually named as Voice of Customers (VOCs). The imperative aspects of QFD studies include the selection of customers' demands and then bearing out their importance of ratings because these meaningfully affect the Final Weights (FWs) and consequent prioritization on three, five, seven, nine or ten-point scales (Jaraiedi, & Ritz, 1994; Bouchereau and Rowlands, 2000; Masui et al, 2003; Dikmen et al, 2005; Tanik, 2010; Utne, 2009; Olewnik and Lewis, 2008). The most frequently practicing norm is the scale of one to five points where 1 stands for very low importance and 5 represents very high importance.

4.3. Technical Solutions (TSs) Section

Once the VOCs and their importance ratings have been determined, Technical Solutions (TSs) is the next process that is actually the technical translation of VOCs in order to achieve the maximum satisfaction of the customer (Bouchereau and Rowlands, 2000). Hauser and Clausing (1988) recommend that each TS is likely to satisfy at least one VOC. This section is very important section of QFD and is called as the heart of QFD methodology (Govers, 1996).

4.4. Relationship Matrix (RM) Section

VOCs and TSs are used together to develop Relationship Matrix that consists of a table of rows (VOCs) and columns (TSs); and illustrates how the VOCs are satisfied through the TSs (Han et al., 2001). The development of RM can be developed with several methodologies like Likert scales, fuzzy logic, AHP, etc. (De Felice and Petrillo, 2011; Khoo and Ho, 1996). The most commonly used method is the ordinal scale where small numbers of scales express weak relationships while bigger numbers represent a strong relationship.

4.5. Determination of the Weighted Matrix

In this section, we determined the weight of each of the SVOP with respect to VOP, by using following equation.

$$W_j = R_{i,j} * I_i, \quad i = 1,2, \dots, r, \quad j = 1,2, \dots, c \quad \text{-----Equation-1}$$

Where W= weight of TS; R=Relationship Matrix; and I= customer priority rating; 'i' is the number of Voice of Parents and 'j' is the number of Technical Attributes.

4.6. Determination of the Final Weights of Technical Solutions

In literature different methods are used for determining final weights. In this study, following equation is used for determining final weights of technical solutions (Jeong and Oh, 1998; Bouchereau & Rowlands, 2000; Hoyle & Chen, 2007; Iqbal, et al. 2014)

$$FW_j(\text{Final Weight of TSs}) = \sum_{i=1}^r R_{ij} * I_i \quad i = 1,2, \dots, r, \quad j = 1,2, \dots, c \quad \text{-----Equation-2}$$

4.7. Procedure of this Study

Following procedure was followed based on the above systematic steps of QFD methodology to conduct this study.

- i. First of all, we focused on VOPs (voice of parents) as VOCs and their importance ratings. VOPs mean the parents' needs and demands. The importance for each VOP is scaled from 1 to 5: 1 means very low importance and 5 means highly important.
- ii. The solution for each VOP (SVOP) is determined in the meetings with teachers, stakeholders, and education experts.
- iii. Relationship Matrix is developed created by measuring the strength of relationship each of the SVOP with VOP.
- iv. In this step, weight matrix is determined by multiplying each of VOP importance rating with each of RM ratings by using equation-1.
- v. Final weights and ranking of SVOP are determined by using equation 2.

5. Data and Discussion

A pilot survey was conducted to collect all possible needs and demands as VOPs. The finalized VOPs along with importance ratings are give in Table.1. Importance ratings were determined on ordinal rating scales from one to five.

Table 1. The Voice of Parents (VOPs) and their ratings

Voice of Parents (VOPs)	Importance Ratings
Developing communication skills of students	4.71
Improving teaching skills	4.52
Religious development of students	4.69
Fair system of evaluating and grading students	4.53
Clarity of course content	4.25

Extra -curricular activities	4.09
Security	4.68
Medical facilities	4.34
Planning for emergencies	4.44
Cleanliness	4.71
Access to teachers and administrative staff	4.04
Availability of transport	4.06

After identifying the VOPs, following SVOP were finally determined in the meeting with teachers, head of school, owner of schools and other stockholders,

Table 2. The Solutions of the Voice of Parents, (SVOPs)

Class discussions
Presentations
Attend training sessions on teaching
Attend seminars related to teaching
Teaching religious values
Including religious content in syllabus
By keeping parents informed
By cracking down on cheating
Explanation of course should be given
Outdoor games should be conducted
Cameras surveillance systems
Card access systems
Administer first aid
Form a team to perform in emergency
Emergency contacts
Appoint cleaning staff
Proper dispose system in school
Well-defined channels should be provided
Meeting hours should be provided to parents
Pick and drop service provided by the school

Now, it is the time to develop relationship matrix (RM) by considering each of the SVOP and its degree to resolve each of the VOP rated on scale of zero to seven. Zero expresses no contribution to resolve while seven means high contribution to resolve the VOP.

The following table-3 expresses the strength of each SVOP with each of VOP.

Table 3. Strength of VOPs with each of the SVOPs

Parents Needs and Demands	Solution of Voice of Parents, (SVOP)	Importance Rating	SVOPs																			
			Class discussions	Presentations	Attend training sessions on teaching	Attend seminars related to teaching	Teaching religious values	Including religious content in syllabus	By keeping parents informed	By cracking down on cheating	Explanation of course should be given	Out door games should be conducted	Cameras surveillance systems	Card access systems	Administer first aid	Form a team to perform in emergency	Emergency contacts	Appoint cleaning staff	Proper dispose system in school	Well-defined channels should be provided	Meeting hours should be provided to parents	Pick and drop service provided by the school
Developing communication skills of students	4.71	6	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Improving teaching skills	4.52	1	1	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Religious development of students	4.69	0	0	0	0	7	7	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Fair system of evaluating and grading students	4.53	0	0	1	1	2	0	7	6	0	0	0	0	0	0	0	0	0	0	0	1	0
Clarity of course content	4.25	0	1	0	1	0	0	1	0	6	0	0	0	0	0	0	0	0	0	0	1	0
Extra -curricular activities	4.09	0	0	0	0	0	0	1	0	0	7	0	0	0	0	0	0	0	0	0	0	0
Security	4.68	0	0	0	0	0	0	1	0	0	7	6	0	0	0	0	0	0	0	0	0	0
Medical facilities	4.34	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0
Planning for emergencies	4.44	0	0	0	0	0	0	0	0	0	1	0	0	6	7	0	0	0	0	0	0	0
Cleanliness	4.71	0	0	0	0	0	0	0	0	0	0	0	0	0	5	6	0	0	0	0	0	0
Access to teachers and administrative staff	4.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	6	0	0	0
Availability of transport	4.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5

Now using VOP Importance Ratings and SVOP relationship matrix strength rating, we develop weighted matrix by using equation 1. This weighted matrix (Table-4) represents total strength each of the VOP with each of the SVOP.

Table 4. The House of Quality with Final Weights of SVOP

Parents Needs and Demands	Solution of Voice of Parents, (SVOP)	Importance Rating	SVOPs																			
			Class discussions	Presentations	Attend training sessions on teaching	Attend seminars related to teaching	Teaching religious values	Including religious content in syllabus	By keeping parents informed	By cracking down on cheating	Explanation of course should be given	Out door games should be conducted	Cameras surveillance systems	Card access systems	Administer first aid	Form a team to perform in emergency	Emergency contacts	Appoint cleaning staff	Proper dispose system in school	Well-defined channels should be provided	Meeting hours should be provided to parents	Pick and drop service provided by the school
Developing communication skills of students	4.71	28	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Improving teaching skills	4.52	5	5	26	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Religious development of students	4.69	0	0	0	0	33	33	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
Fair system of evaluating and grading students	4.53	0	0	5	5	9	0	29	25	0	0	0	0	0	0	0	0	0	0	5	0	0
Clarity of course content	4.25	0	4	0	4	0	0	4	0	27	0	0	0	0	0	0	0	0	0	4	0	0
Extra -curricular activities	4.09	0	0	0	0	0	0	4	0	0	27	0	0	0	0	0	0	0	0	0	0	0
Security	4.68	0	0	0	0	0	0	5	0	0	33	29	0	0	0	0	0	0	0	0	0	0
Medical facilities	4.34	0	0	0	0	0	0	0	0	0	0	0	0	28	0	0	0	0	0	0	0	0
Planning for emergencies	4.44	0	0	0	0	0	0	0	0	0	4	0	0	27	32	0	0	0	0	0	0	0
Cleanliness	4.71	0	0	0	0	0	0	0	0	0	0	0	0	0	25	28	0	0	0	0	0	0
Access to teachers and administrative staff	4.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	23	0	0	0
Availability of transport	4.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19
Weights			33	33	31	37	42	33	42	30	27	27	37	29	28	27	32	25	28	27	32	19

Table 5. The Final Weights of Solutions of the Voice of Parents (SVOPs)

Solution for Voice of Parents	Class discussions	Presentations	Attend training sessions on teaching	Attend seminars related to teaching	Teaching religious values	Including religious content in syllabus	By keeping parents informed	By cracking down on cheating	Explanation of course should be given	Out door games should be conducted	Cameras surveillance systems	Card access systems	Administer first aid	Form a team to perform in emergency	Emergency contacts	Appoint cleaning staff	Proper dispose system in school	Well-defined channels should be provided	Meeting hours should be provided to parents	Pick and drop service provided by the school
Final Weights	33	33	31	37	42	33	42	30	27	27	37	29	28	27	32	25	28	27	32	19

The table-5 highlights the final weights under each of the solutions of the Voice of Parents (SVOPs)

Table 6. The Final Weights of SVOPs with their respective ranking

Solution for Voice of Parents	keeping parents informed	Teaching religious values	Attend seminars related to teaching	Cameras surveillance systems	Presentations	Including religious content in syllabus	Class discussions	Emergency contacts	Meeting hours should be provided to parents	Attend training sessions on teaching	By cracking down on cheating	Card access systems	Proper dispose system in school	Administer first aid	Well-defined channels should be provided	Form a team to perform in emergency	Out door games should be conducted	Explanation of course should be given	Appoint cleaning staff	Pick and drop service provided by the school
Final Weights	42	42	37	37	33	33	33	32	32	31	30	29	28	28	27	27	27	27	25	19
Ranking	1	1	2	2	3	3	3	4	4	5	6	7	8	8	9	9	9	9	10	11

The table-6 shows the relative ranking calculated for the Solutions of the Voice of Parents (SVOPs) on the basis of their final weights. The final results show that 'keeping parents informed' and 'Teaching religious values' are two most important SVOPs with final weights of 42 each while 'Attend seminars related to teaching' and 'Cameras surveillance systems' are the second most important SVOPs with final weights 37 each. On the other hand, 'Pick and drop service provided by the school' is the least important SVOP. In table-1, the VOP section, we see both 'Developing communication skills of students' and 'Cleanliness' have the highest importance ratings, 4.71, while 'Religious development of students' is the second highest important VOP with importance rate of 4.69. On the other hand 'Access to teachers and administrative staff' and 'Availability of Transport' is the least important VOPs with importance ratings, 4.04 and 4.06, respectively.

6. Conclusion

In this article, we described how needs and demands of a problem can be determined systematically and then how these problems can be resolved by determining their technical solutions. The case study to improve the primary school system of private schools is a model study and provides direction to improve other dimensions of schools' system. The problems and technical solution may vary from institution to institution and there are other factors for example cost, time, availability etc. which practitioners/researchers have to consider.

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