

# The Evaluation of Secondary Education Basic Mathematics Curriculum through Stake's Responsive Evaluation Model\*

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**Abstract:** The major aim of this study is to evaluate the 11<sup>th</sup> grade Basic Mathematics (BM) Curriculum implemented at a Vocational and Technical Anatolian High School (Tourism and Hotel Management) through Stake's Responsive Evaluation Model, and to depict to what extent it responds to the needs and career plans of its students. In this study, qualitative case study design and criterion sampling methods were employed. The data were gathered via observation schedules, document analysis, and semi-structured interviews with 43 participants. Data were analysed via systematic content analysis, inductive coding, and thematising. The results showed that the implementation of the 11<sup>th</sup> grade BM Curriculum, to a large extent, did not respond to the needs of this specific school, and the students were not able to transfer their math skills to other courses. Though the students used their math skills in their daily lives to an extent, their utilisation of mathematics in their vocations was quite limited. Implications suggest that teachers in the school (micro-level) need interdisciplinary cooperation, setting school performance criteria relevant to vocational high schools at the district level (mezzo-level) and creating and implementing relevant curricula for vocational high schools at the state level (macro-level).

**Keywords:** Curriculum evaluation, Stake's responsive evaluation model, vocational and technical high school, basic mathematics curriculum

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## Introduction

Education's general aim has been to prepare each new generation for productive working life in any systemised society (Coombs, 1985). Besides its general aim, vocational education aims to acquire qualifications related to a certain profession, art, or employment. Even though its training program also includes general education elements, it provides the necessary training to acquire appropriate skills and technical knowledge so that students can exercise a profession, art, or activity (Kotsikis, 2007). When considered, vocational education cannot be differentiated from the purpose of general education except for its curriculum content and implications. The main objective of vocational education is to provide the economy with skilled human power and thereby to help countries develop their economic growth (Bennell & Segerstrom, 1998; Bertocchi & Spagat, 2004; Gray, 1993; Hoeckel, 2008; 2010; Ismail & Hassan, 2013; Kreysing, 2001; Lewin, 1993; Meer, 2007; OECD, 2010; 2014; Olkun & Simsek, 1999; Oxtoby, 1993; Ozer, 2018; Psacharopoulos & Patrinos, 1993; Wheelahan & Moodie, 2016).

Yet, improving the fit between education and work has received much attention for a long time. Psacharopoulos (1991) raised questions to depict concerns about establishing a match between education and work; such as (1) how to provide a school curriculum that is relevant to the world of work; (2) how to improve graduate unemployment statistics; (3) how to prevent the one-way street from school to the university; and (4) how to provide the necessary skills needed by the economy. In this regard, Olkun and Simsek (1999) state that to understand whether a particular training is relevant to the world of work: (1) students' ability and interest, (2) curriculum relevance in terms of content, teaching materials, and teacher training, and (3) employment conditions are needed to be assessed.

Accordingly, this study focuses on implementing academic content in vocational education and investigates whether it matches students' interests, perceived content relevance, and employment conditions. It yields a reflection on the 11<sup>th</sup> grade Basic Mathematics (BM) Curriculum, which can be implemented at both vocational and mathematically non-weighted departments at general high schools. Thereby, the study is expected to provide a broad perspective regarding whether the BM Curriculum responds to the needs of the students in a particular vocational high school inclusive of a wide variety of stakeholders and audiences through Stake's Responsive Evaluation Model.

## Vocational Education and Basic Mathematics Curriculum

Ernest (2000) brings together the aim of teaching mathematics under three dimensions in terms of useful or necessary mathematics for employment and the economy, social and personal mathematics for personal and social relevance and appreciation of mathematics as an element of culture. Accordingly, the necessary mathematics is divided into three subcategories for the benefit of employment and society from an economic perspective and sustaining mathematics and mathematical interests themselves.

First, Ernest (2000) indicates that functional numeracy involves deploying math and numeracy skills adequate for successful general employment and functioning in society. It is described as a basic and minimal requirement for all students at the end of schooling, excluding those few preventive disabilities. Secondly, practical and work-related knowledge involves solving practical problems related to industry and are work-centred by using mathematics. It is described as unnecessary for all students; however, provide the basic understanding and capabilities upon which further specialist knowledge and skills can be built. Third of all, advanced specialist knowledge involves understanding advanced mathematic knowledge in high schools or universities. This knowledge is not a necessary goal for all but is desired or needed by a minority of students. Yet, Ernest (2000) suggests that this option must be available in schools, and indeed more students should be encouraged to pursue it. However, he emphasises that it should not dominate or distort the school mathematics curriculum.

Those subcategories are enlightening and identify the aim of teaching mathematics. Compared to those subcategories, a similar case also emerges in the Secondary Mathematics Curriculum of Turkey. The Secondary Mathematics Curriculum (Ministry of Education [MoNE], 2017; Revised in 2018) offers two elective mathematics courses (main course and basic) following students' needs, preferences, interests, and career plans. Indeed, the BM Curriculum shares the main goals with the Main Mathematics Curriculum yet is selected by students who would like to trace an alternative career path other than mathematics weighed departments at higher education. Under such circumstances, students may select basic maths course in 11<sup>th</sup> grade and follow it in 12<sup>th</sup> grade.

In terms of context, while elective main mathematics courses are implemented at Anatolian High Schools, and the elective basic mathematics course is implemented at Vocational and Technical, Fine Arts and Sports, and Anatolian High Schools, of which students have not selected mathematically weighed departments (such as non-mathematics courses or languages). In line with the Secondary Mathematics Curriculum, the basic mathematics course can be taught two hours a week in 11<sup>th</sup> grades. The BM Curriculum aims (MoNE, 2017 Revised in 2018);

To equip students with the skills required to utilise those skills in their daily and occupational lives effectively. The BM Curriculum intends to foster students' problem solving, reasoning, and decision-making skills and help them use mathematics to make decisions. Concerning this, in 9<sup>th</sup> and 10<sup>th</sup>-grade mathematics curricula, some concepts and relations are taken into account via real-life problems. Thus, students selecting non-mathematics weighted departments in the next grade are foreseen to deal with real-life problems more effectively. Therefore, as is stated in the blueprint, the goal of the BM Curriculum is to develop students' problem-solving skills.

To reach those desired aims, the points to be considered are as follow MoNE, 2017 Revised in 2018):

1. Students are to be introduced to real-life problems and be taught how to deal with them,
2. The problems designed are to include situations in which students would utilise their reasoning and decision-making skills,

3. Problems are to be related to students' cultural environments and should include situations related to their families and immediate surroundings,

4. In lessons, real-life situations and problems should be the starting point, and students should feel the need to learn some topics and concepts. In this frame, the concepts of interest should be dealt with in the processes of problem-solving.

The students should collect, organise, analyse data, and present their results to achieve the curriculum aims via the Project-Based Learning Strategy (PjBL). In light of those aims, vocational and technical high school students may improve their core cognitive skills in mathematics, such as problem-solving, reasoning, and critical thinking. As is presumed in the curriculum, when students are equipped with those skills, they can succeed in their occupations and function efficiently in society.

Regarding this fact, the implementation and outputs of the BM Curriculum become another concern of this evaluation study.

## **Program Evaluation and Stake's Responsive Evaluation**

Gredler (1996) defines program evaluation as "the activities of collecting information about the operations and effects of policies, curricula, courses, and other educational materials", and as a systematic inquiry design, it provides information for decision-makers or groups interested in a particular program, policy, or other intervention. Ornstein and Hunkins, on the other hand, describe evaluation as a three-step process; "delineating the information necessary for collection, obtaining the information, and providing the information to interested parties" (1998, p. 330). Gredler (1996) emphasises the importance of the evaluation process by suggesting it to be conducted at any of several phases of the program development and implementation. Moreover, he classifies the evaluation approaches as utilitarian and pluralist approaches represented by different evaluation models (Gredler, 1996). The utilitarian perspective expands the types of decisions and data sources appropriate for evaluation, particularly for decision-makers. In contrast, the pluralist perspective addresses various group interests in a program and/or sought to identify the underlying dynamics of program operation (Gredler, 1996).

As a pluralist one, in a responsive approach to evaluation (Abma & Stake, 2001; Greene & Abma, 2001; Guba & Lincoln, 1989; Stake, 1975), evaluation is not exclusively focused on the assessment of policy interventions and programs based on their effectiveness; moreover, it focuses on engaging all related stakeholders according to their practice. It mostly focuses on stakeholder issues and engages stakeholders in dialogues about the quality of their practice (Abma et al., 2001). The aim is to heighten the personal and mutual understanding of stakeholders, which would serve as a vehicle for practice improvement (Abma, 2006; Abma et al., 2001). This program evaluation model responds to audience requirements for information and refers to different value perspectives in reporting the merits and shortcomings of the program under interest (Abma, 2006; Stake, 1975). There are three responsive evaluation activities: the initial planning and focusing of the evaluation, conducting observations, and organising and

reporting. These activities are not divided into phases because observation and feedback (reporting) are important activities for reaching a holistic perspective during the evaluation studies (Stake, 1975).

In Stake's Responsive Evaluation Model, the evaluator's primary task is to become acquainted with the program by observing program activities, examining relevant program documents, and interviewing stakeholders, to better understand the meaning of the stakeholder's interaction with the program (Abma, 2006; Stake, 1975; Stake, 1990). The evaluator then selects a few issues around which to organise the study and checks their ideas with individuals representing different audiences. Once the initial issues are identified, the evaluator selects appropriate methods for data collection. These decisions can be made by discussing several alternatives and negotiating with program staff and the evaluation sponsors (Stake, 1990).

On the other hand, a common misunderstanding of responsive evaluation identified by Stake (1990) is the erroneous belief that it is synonymous solely with qualitative inquiries. Instead, the evaluation may be conducted by following either a qualitative or quantitative approach in research. It is important to state that the selected methods must serve the information needs of the various audiences (Stake, 1990). Stake (1990) depicts that one concern in responsive evaluation is the use of participant testimony as a major data source. Therefore, Stake (1990) emphasises the importance of establishing the reliability of the data. In this manner, the evaluator should obtain the reactions of program personnel, exhibit their portrayals, check the relevance of evaluation findings, and share the results with the stakeholders. Stake (1973) remarks that much of this effort is mostly informal and may be ongoing during the evaluation, so that organising and reporting information in the responsive evaluation may occur at various times and in various ways. Different reports may be prepared for different groups according to emergent needs and the circumstances in the evaluation context (Stake, 1990). It is suggested for the evaluator to use portrayals often to provide a vicarious experience of the program. Some portrayals of a program may be short, such as a five-minute script, a log, or a scrapbook. Longer portrayals, however, may consist of narratives, photographs, maps and graphs, exhibits, and taped conversations (Stake, 1975). In this respect, Stake's Responsive Evaluation Model can help provide various information derived from various issues and conversations with different stakeholders to increase the personal and mutual understanding of stakeholders in practice improvement.

## **The Purpose of the Study**

In the light of the framework that discussed Stake's Responsive Evaluation Model, the major concern of this study is to create an understanding and a dialogue among stakeholders in mathematics regarding the needs and career plans of vocational and technical high school students (as a concept of Tourism and Hotel Management High School). Depending on the articulations of teachers as a result of informal conversations in this specific context, there was a probable mismatch between the expectations of the BM Curriculum and the teachers' statements related to student skills needed for the

sector of tourism. Additionally, student performance dissatisfaction in mathematics courses, based on teachers' articulations and the negative feedback provided by supervisors observing students during their internships, constituted the starting point of this study. Those problems, which seemed to be discussed among stakeholders, paved the way to question whether the curriculum was responsive to the needs of this specific vocational and technical Anatolian high school as a matter of research. As a result, the focus of the study shaped around reflecting upon the BM Curriculum in this specific context to find out whether it was preparing students for their prospective vocation. Accordingly, the purpose of this study is to evaluate the 11<sup>th</sup> grade BM Curriculum to reveal whether and how this curriculum responds to the needs of this vocational and technical Anatolian high school through a responsive evaluation model. This study will be used as a set of recommendations to improve the mathematics curriculum implementation in such schools. The following research questions were answered to achieve the purpose of the study. The research questions specified below were determined to be in line with the characteristics of Stake's Responsive Evaluation Model.

1. Does the implementation of the 11<sup>th</sup> grade BM Curriculum respond to the context of a Tourism and Hotel Management Anatolian High School?
2. What are teachers' opinions about the transference of the competencies attained via the 11<sup>th</sup> grade BM Curriculum into the vocational and cultural courses (chemistry, biology)?
3. What are graduates' opinions about the effectiveness of the 11<sup>th</sup> grade BM Curriculum concerning the transference of the math skills attained into their daily and vocational lives?
4. What are supervisors' opinions about the effectiveness of the 11<sup>th</sup> grade BM Curriculum concerning the transference of math skills into students' vocational lives?
5. What are parents' opinions about the effectiveness of the 11<sup>th</sup> grade BM Curriculum concerning the contribution of math skills into students' daily lives?

## Method

### Research Design

This study was carried out through a case study design. Yin (1984, p. 23) defines the case study research method as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used". In this respect, the case study design was selected as it was in great harmony with the nature of the study. Thus, the researcher will collect data from various participants and

dig into different perspectives in the real-life context of the BM Curriculum at a vocational and technical Anatolian high school.

Bogdan and Biklen (2007, p. 59) offered the metaphor of a funnel to describe best how a case study design should be represented. "The start of the study is the wide end. In time they [researchers] make specific decisions on what aspects of the setting, subject, or data source they will study. Their work develops a focus". This feature was best represented when researchers scouted for possible locations and people to decide upon their feasibility. Following the preliminary site visits and identifying the location to be searched for, the Gantt chart was scheduled to show the time distributed to whom per se to interview and what to explore. This short preliminary plan was held flexible as it was a stark contrast to the nature of qualitative research to set strict boundaries. To give shape and decide upon what to explore and/or who to interview, one of the researchers' weekly visits to the school and classrooms played a major role in true consistency with the design characteristics. These visits and observations were to shape and modify the research, and more was learned about the topic each time. Thereby, the focus of the study was developed, and the research questions were reformulated and modified. This study, which had begun with a broad exploratory initiative, was executed by more explicit data collection and analysis procedures compatible with the case study design and Stake's Responsive Evaluation Model.

## **Participants**

The sampling method emerged from the regular school visits and the context in which the curriculum was being implemented. As Patton (2002) stated, the nature of qualitative research is well intertwined with purposeful sampling. Additionally, as underlined by Patton (2002, p. 230), "the power of purposeful sampling lies in selecting information-rich-cases for study in-depth. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the inquiry". That is, accessing the rich-informant cases "yields in-depth understanding and insights", which is not possible through empirical generalisations (Patton, 2002, p. 230). In order to access the informants who would give the richest and most quality data, Stake's Responsive Evaluation Model was selected as it was appropriate for achieving the purpose of this study. Among purposeful sampling methods in qualitative research, the criterion sampling method was selected. Various participants gave voice to as many different stakeholders and participants as possible with the criterion sampling method. It prevented the loss of quality data regarding the implementation of the curriculum. Besides, the chosen sampling method is also relevant to the case study design, which aims to understand the phenomena from different real-life contexts. In this context, criteria were determined to avoid losing quality data regarding reaching different perspectives. To create an understanding from different perspectives and to enlighten the research questions, the data were collected from various participants: students, mathematics teachers, administrators, parents, vocational course teachers, supervisors, and graduates by mainly using the criterion sampling method as is described below.

In this respect, the criteria for the students were determined as “highly interested and successful in mathematics courses”, “moderately interested and successful in mathematics courses”, and “low-interest and success in mathematics courses”. The purpose was to give voice to various perspectives and dig into reality. The rationale behind identifying these criteria was to minimise the probabilities of collecting data from similarly characterised participants. Moreover, to ensure variety, the sample of each focus group consisted of students from Foods and Beverages (F&B) and Accommodation and Travel (A&T) departments. This way, it was assured that the reality was represented through a wide range of perspectives and that accessing rich-informant cases in case study designs was confirmed.

Another group of participants includes mathematics teachers. The criterion identified to select mathematics teachers was determined as “teaching this course in this specific school at the academic year this study was conducted”. As parents are one group of the stakeholders who would have the chance to observe students’ math skills’ contribution to daily lives and assure variation of the data collected, they were also included in this evaluation study. The criteria identified and employed for sampling the students served as a basis for sampling the parents. Accordingly, two parents were selected from “highly interested and successful in mathematics courses”, two parents from “moderately interested and successful in mathematics courses”, and one parent from the “low-interest and success in mathematics courses”, which resulted in five parent participants in total. Regarding the sampling of administrators, the criterion was identified as “being in the administration board at this specific school”. According to this criterion, the participants consisted of one principal and one assistant manager.

Before embarking upon the sampling of cultural and vocational course teachers, better to clarify that in Turkey, at vocational high schools, courses are categorised as cultural and vocational courses. Cultural courses such as mathematics, biology, chemistry, Turkish language and literature, history, and so forth enhance students’ personal development and social skills. As the related research question was based on the transference of math skills into other mathematically weighted courses, the criterion of determining cultural course teachers was identified as “teaching biology, chemistry, or physics at this specific school”. About the vocational course teachers, as there were two major departments, Food and Beverages (F&B) and Accommodation and Travelling (A&T), assigned at the school, the criterion was identified as “being a teacher in F&B and A&T departments”. Here, sampling vocational course teachers gave voice to varied audiences affected by this curriculum and shed light on how math skills were transferred into students’ vocational courses and vocational skills. For this purpose, three F&B and; two A&T teachers were selected to contribute to the data collection processes.

As for the supervisors, the criterion was identified as “working to observe students on the job during their internships in F&B or A&T departments”. Therefore, one general director representing A&T and one chef from F&B participated in the study. The reason for incorporating supervisors from both departments was to reveal the reality and any probable varieties (if they existed) within both departments.



As in most evaluation studies, the overall aim is to assure improvement and adjustment according to the results gained, depending on the phenomena investigated alongside the current users, the opinions of other users who were (or would be) exposed to the phenomena. In our case, graduates' opinions were crucial as they were exposed to the same curriculum and had post experiences that would yield information for achieving the purpose of this study. Regarding the graduates, both criterion and convenient sampling methods were employed. The criterion identified for graduates was "being a graduate of this specific school from either department of F&B or A&T". The sample in this group consisted of two F&B and four A&T graduates.

## Data Collection Instruments and Procedures

In this study, interviews, observations, and document reviews were employed as data collection methods. The interview and observation schedules prepared by the researchers served to collect the data as data collection instruments. During and after the preparation of the schedules, expert views were consulted. Eight different interview schedules were prepared to collect data from eight data sources. The data were collected from three student focus groups ( $n = 18$ ), individual interviews with two mathematics teachers ( $n = 2$ ), two administrators ( $n = 2$ ), five vocational course teachers ( $n = 5$ ), two cultural course teachers (biology and chemistry) ( $n = 2$ ), five parents ( $n = 5$ ), six graduates ( $n = 6$ ), and three practice supervisors who the students work together with during their internships ( $n = 3$ ), which in total were 43 ( $n = 43$ ) participants involved into the study voluntarily. Students' focus groups were repeated the following week, and the individual interview transcriptions were member-checked to check for biases. The data from observations and documents (teachers' resource pack, students' notebook artefacts, and samples of the written exam) were collected simultaneously. In total, 14 hours (per 40') of in-class observations were conducted via the observation schedule formed accordingly with a thematic approach.

Following each observation, observation notes were transformed to extended notes, and if necessary for that observation, memos and reflexive journals were kept to check for personal bias. The aim of conducting observations was to use it as a supportive data collection method and identify the students for the focus groups in line with the sampling method. During and after observations, the students of highly, moderately, and low interest and success in mathematics courses were identified via insights of observations, their teacher's opinions, and the database of e-Okul (*e-School, as a School Management System*) in which grades and improvements of students for every lesson were recorded.

On the other hand, the focus groups of the students were conducted and tape-recorded at the school library. The duration of the focus groups varied between 38 to 50 minutes. There were six students whose consents were taken beforehand, both from A&T and F&B departments, in each focus group. The repeat sessions were held a week later to increase the dependability of the study. Meanwhile, the individual interviews were held simultaneously according to the arrangement or the convenient conditions emerging within time. For privacy concerns, the teachers were interviewed at the school library at

scheduled times. Three of the graduates were interviewed at a privately arranged cafe. The other three graduates and parents were interviewed via multimedia applications because of the inconvenient conditions for face-to-face interviews. The supervisors were visited at the hotels, and interviews were conducted in private. Procedures conducted were codified and tagged as Fcg (focus groups), Ad (administrators), Vct (vocational teacher), Cct (cultural course teacher), Sp (supervisor), Pr (parent), and Gr (graduate).

## **Analysis of the Data**

The data collected were transcribed using the transcription programs of Express Scribe and Listen N Write. Following the transcriptions of the interviews, the data were analysed via Systematic Content Analysis, inductive coding, and thematising. As the observation extended notes were kept in line with the thematic approach, an extra analysis was not conducted. In the analysis, as the main data collection instrument, the interview findings were supported via the findings in the observations and the document analysis. The results were reported in a triangulated manner.

For assuring the *credibility* of the study, “*prolonged engagement*”, “*persistent observation*”, “*member checks*”, “*peer debriefing*”, and “*triangulation*” strategies (Creswell, 2014; LeCompte & Goetz, 1982) were used. Concerning *prolonged engagement*, long-term engagement in the research site was of excellent significance as the responsive evaluation model’s major set off bases are built upon this fact to determine whether the curriculum responds to the needs of the context it is implemented in. Eight weeks (two for engaging with the atmosphere and needs assessment, six for conducting observation) were spent actively in the field to meet this criterion.

In terms of *persistent observation* to collect accurate and relevant data, the first two weeks were used to identify accurate data sources. In the following, in-class *persistent observations* were conducted to bring insights into the curriculum: the way it was delivered to the students and how the students responded to the curriculum and the other factors affecting the implementation. Additionally, in line with the *persistent observation* strategy, chats with the teacher were conducted to confirm the observation notes following each class. Furthermore, extended notes were developed and transferred to the digital platform to be kept coded and analysed following each observation. Another strategy called *member checks* was used to ensure *credibility* so that the interview transcriptions could be shown or sent to participants. After the analysis, chats were conducted regarding the results to increase the accuracy.

Another strategy used to confirm *validity* was *peer-debriefing*, in which the two partners checked the design, the model, and the results of the study to confirm the accuracy. As this is a case study design and the responsive evaluation model is employed, collecting data from as many stakeholders and audiences as possible calls for the *triangulation* of the data. *Triangulation* was used in supporting the main data findings of the interviews with observation and document analysis.

Consequently, the *external reliability* of the study was established via presenting the methods of data collection procedures clearly so that other researchers will be able to use the reporting to replicate the study (e.g., Becker et al., 1968; Mehan, 1979; Ogbu, 1974; Smith & Geoffrey, 1968; Wolcott, 1977; LeCompte & Goetz, 1982, p. 10). Concerning the establishment of *internal reliability*, to answer whether multiple observers agree within a study, the data was recorded mechanically to help correct researchers' misperceptions and misinterpretations. In summary, to confirm the *credibility* and *transferability* of the study, more than one strategy was used. In this sense, this study can be said to represent sound credibility and transferability bases.

## Results and Discussion

In answering the first research question concerning whether the implementation of the curriculum under concern responded to the context of Tourism and Hotel Management Anatolian High School, various data collection methods were employed. In this respect, focus group interviews with students, individual semi-structured interviews with administrators, assistant managers, and mathematics teachers in charge of teaching this course, observations and document analyses were conducted. As a result of the student focus group interviews, the data's content analysis and open coding revealed that students set a positive relationship between their jobs and mathematics. This course is found vital for both self and business and is perceived as a means of excelling in their job. The self-projection regarding the effective utilisation of this course revealed that students, to a large extent, were unconfident and insecure as they define their ability level only around four basic mathematical calculations.

Additionally, findings suggested the existence of irrelevant content in the curriculum, such as scales and trigonometry. The analysis indicated that daily life connections were set to an extent, though, setting relevance to students' vocations, if at all, was student-initiated rather than teacher-initiated for A&T students while was non-existent for the F&B department. This case is revealed in the student focus group responses, giving insights into the lack of orientation of cultural course teachers teaching in vocational high schools.

Once I said, teacher, this is like ...at the hotel! And she went on like, 'Okay, if you think the way you do it there, you learn easier! She confirmed us but then she drew back and went on her own way of teaching. [Fcg 1]

...no relevance is set to our vocations. Yet, this is not the teachers' fault. They are cultural course teachers, and they are not familiar with our departments. So, I think they do not know how to relate to our vocations." [Fcg 3]

The analysis of the interviews with mathematics teachers suggested that while teachers were aware of the importance of *actualising information via contextualisation*, the ways they could bridge the gap to those students emerged to be no more than the mention of the topics *transforming quantities* for F&B; *percentages* and *profit-loss calculations* for

A&T, rather than the actual reality of those students. Additionally, the analysis of mathematics teachers' responses referred to a lack of satisfaction with the curriculum as it was found to be not appropriate for the context it was implemented and mostly irrelevant to the needs of this specific group of students. One of the teachers mentioned that the language of the curriculum was not addressing this specific group of students.

Is the curriculum well-suited for vocational high schools? I think not! It is heavy! These are vocational students, and I know they learn more easily when I set connections to their lives. For example, in teaching percentages and profit-loss calculations, a couple of examples for accommodation students can be given, but it is not possible for all topics. [Mt 1]

Actually, sometimes in terms of daily life, yes, their interest grows when I give examples or ask questions... But, no, we cannot do that (set connection to students' (vocations/departments). Students do not have an interest in the lesson already. [Mt 2]

We are expected to help the students do better in the university exam. You know! Students leave the school earlier compared to other schools for internships, so I have limited time to finish the curriculum. ...we already have common exams in the district. Therefore, all high school students, regardless of the type of school, are assessed compared to the same curriculum. After that, we conduct the second written exam only. Performance scores are given compared to the participation of the students in the lesson, and that is all. [Mt 2]

That is to say, compared to the requirements of the official BM Curriculum, it was found that teachers did not use any project-based assessment practices. Time constraints stemming from the academic calendar reported being shorter than other high schools seemed to be the primary handicap in implementing the curriculum. Time constraints, the pressure put on teachers for increasing the number of students being successful in the university entrance exam and the assessment practices on the district level may have distracted teachers' focus from the essence of the curriculum. From the administrator point of view, the enhancement of mathematics to the students' daily lives was of consensus that this course nurtured students' abilities to set relations among phenomena, analytical thinking, and *setting cause and effect relationships*. Yet, in the implementation of the curriculum, the so-called reasons for not being able to enact the document (the curriculum) as it should be, emerged as *shortcomings of the academic calendar* and thereby resulting in the intensive program implementation, *curriculum coverage concerns, disharmony of the curriculum and the school type*.

...the aim of vocational education is to raise semi-qualified intermediate staff for the sector. Yet, though not true to say this way but, we enforce the curriculum implemented at other Anatolian high schools to our students. This way, we neither raise students for the sector nor for the university. [Ad 2]

Moreover, the findings underlined the concerns stemming from the *lack of alignment of the curricula*; though the schools would indeed implement the written curriculum at mezzo-level (district level), the performances of the schools were *university entrance exam-oriented*, so it was at micro-level (schools) under the pressure of the number of students entering the university, as well.

Unfortunately and frankly to say, I am not after daily life or vocational relevance to students' jobs. The district ranks all high schools based on just one criterion: the number of students entering a university! So, if a student can answer four or five questions more, I do not question how the curriculum is implemented. [Ad 1]

In response to the first research question, in the light of the reality uncovered in this context, it can be said that the implementation of the 11<sup>th</sup> grade BM Curriculum does not respond to the needs of this specific school. To this effect, in line with the insights delivered from the data, the literature also supports that the curricula for vocational high schools should be different rather than implementing the same curricula at all secondary schools as they raise students each for differentiated ends. Accordingly, irrelevant contents should be excluded corresponding to the needs of those schools (Ciftci & Tatar, 2015). Likewise, Aydin et al. (2018) indicated that implementing a particular curriculum at all secondary schools, despite the variation of the type of schools, was almost impossible to achieve. Therefore, different curricula should be built responding to the type of institutions.

On the other hand, Mumcu et al. (2012) emphasised the need for an infusion of daily life when teaching mathematics. As revealed in their study, 'students will like mathematics only if they meet mathematics alive'. Though the other facet, in this case, relates to issues like university-oriented performance assessments of schools based on an overall evaluation of all secondary schools, when the case is learning for self, the reality independent of the reasons uncovered refers to the need for learning and teaching for life.

For the second research question, the endeavour for answers shaped around the teachers' opinions related to the transference of the competencies attained by students via the 11<sup>th</sup> grade BM Curriculum into the vocational and cultural courses. Three vocational and two cultural course teachers were individually interviewed to answer this research question.

The analysis of the A&T teachers' responses indicated that students' transference of math skills to their courses was *limited* and *not effective*. The data analysis referred to the fact that the reasons for this case were heavily student and teacher-based. Regarding the student-based reasons, concepts distilled such as *low reasoning skills, low ability to inquire, learned helplessness, low self-confidence, low motivation, and low comprehension abilities* were more about the characteristics of the students.

...In the exam, I gave a long paragraph which described the hotel in detail including redundant information, as well. What I wanted them was to derive the required information and do a simple direct proportion calculation, but what they did was trying to use all the information given. They could not understand the question. Actually, they know how to calculate, but when they come across a problem, they cannot apply what they know. Indeed, what was required was to derive the required information, multiplying and a simple division. [Vct 1]

I work with three students this year in the coaching project in our school. When I ask why your math grades are bad? They just answer as 'I am unwilling, I do not like maths! I do not think I

can ever be good at maths!' Please do not take me wrong maths teachers! But there must be a way to motivate them. [Vct 2]

On the other hand, the concepts emerging as *prejudices against mathematics*, learning via *memorisation* and the *means-oriented approach* of students for GPA rather than handling it as a way of life were more about how students perceive this course.

There already exist stigmas related to vocational high school students. Unsuccessful students with low grades who cannot do maths go to vocational high schools! So, students come to this school stigmatised as not successful. This is selective perception. They just say, 'I cannot do maths!' ...with the anxiety and fear they feel, they just focus on taking good grades for keeping their GPA at a level instead of thinking on how they can use maths skills in their jobs, lives or in other courses. [Vct 1]

As a result, it can be inferred that the students could not see the bigger picture because of the varied reasons mentioned and therefore were missing the chance of seeing the hidden strings among courses. On the other hand, concerning the teacher-based reasons, *assumptions of prior knowledge* of the students, *concerns of curriculum coverage*, and *ineffective use of strategies and methods* were the distilled concepts. In this respect, the analysis of A&T teachers' comments referred to the fact that teachers' assumptions on prior knowledge of the students led mathematics teachers to use terminology or concepts which students know as a reflex by name but do not comprehend its use or logic. As various audiences reported in this school, students were more inclined to establish closer relations with their vocational teachers as they spent most of their time with them. Additionally, as A&T teachers teach accountancy, their observations with students in mathematics experiences were reflective and helpful in answering our research question. To that effect, what emerged was a sincere call to mathematics teachers on how to teach and cooperate.

There is not a well-tailored maths curriculum relevant to the aims of our school. Our maths teachers have to cover the curriculum in a much shorter time. Students turn back in October from internship and leave again in April. Everybody is in a rush in cultural courses. Therefore, cooperation among teacher groups stays only on paper. [Vct 2]

If you teach directly via terms or concepts, our students do not grasp what you teach. For example, if you directly use the concepts of active asset, passive asset, students can get scared. Maths is already something like coming from space for them. Therefore, by using simple daily language and real-life scenarios, I believe students can learn maths better. For example, before using the concept of active - passive asset, I start with 'If we lend money to X, ...' 'If we borrow money from Y,...'. Maths teachers no offense! I know the curriculum is crowded, but you need to change the way you teach these students a little bit. [Vct 1]

On the other hand, when it comes to facing the results of not being able to transfer math skills into the vocation, the students understand this other facet at the price of *pay cuts* or *loss of jobs*. It is indicated that math skills in students' lives prove their significance sooner or later.

...when do we pay taxes, what is tax on corporations, how do we pay the income tax, what is a wage, and what do we record daily? What do we do if the guests pay in cash or by credit card? These are all mathematically related questions, but our context is the hotel, and we have to be

very careful...there is no mercy in business! Even a penny is valuable. Therefore, our students know that when your calculations go wrong, it means you damage the business. You damage my business, you are fired! If lucky enough, they cut the damage from your wage! [Vct 2]

The analysis of the F&B teachers' interviews indicated that the students could not transfer their math skills attained into the F&B courses. The enhancement of mathematics into the qualification of this department emerged to be precious for *reaching standards, improving the quality in a restaurant, balancing the ingredients in the dishes, balancing the portion size, and preventing financial loss*. The reality for F&B concerning mathematics emerged as a 'no less, no more' philosophy. Yet, in the light of the analysis, students come to this course with *low analytical thinking skills and conceptual problems* (i.e. quantities of solid and liquid) and therefore experience difficulties in the kitchen.

At the beginning of the term, we teach chopping the veggies. When I ask them to bring a bowl or a cutting board, they bring a quite small or big one compared to the ingredient. Math gains students compare and contrast and analytical thinking skills. [Vct 5]

...fractions! They do not know what it means  $\frac{1}{4}$ . Then, we take a lemon and divide it into four pieces and show a piece that it is  $\frac{1}{4}$ . [Vct 5]

The largest two reasons for this case emerged to be the *assumptions of prior knowledge and prejudices of students towards mathematics courses*. The analysis of A&T and F&B teachers' interviews pointed to the reality that the students in this specific context carry characteristic features; they are already immersed in fear of not achieving mathematics as it is either too abstract or too difficult. Those findings refer to the self-fulfilling prophecy concept (Vanderlaan, 2011) as the failure of achieving the course is blamed on the false self-concepts and beliefs held by the students. The literature in this regard presents overlapping results in that most of the students at vocational high schools suffer from prejudices (Berkant & Gencoglu, 2015), anxiety, and learned helplessness identified in the saying 'I already cannot do maths' undermining their confidence in achieving this course. Additionally, as indicated in the study of Berkant and Gencoglu (2015), teachers mostly employ deductive teaching methods, which also is the case in this study, proving to be ineffective based on the teacher's thoughts. Therefore, in addressing mathematical content, reasoning, and problem-solving skills, teachers need to tailor and provide various methods such as games and drama activities (Bucheister et al., 2017). Different from the findings of Mumcu et al. (2012), according to the perspectives of vocational course teachers in this study, the students were aware of the future effect of mathematics on their vocations and lives rather than underestimating it. Students were found to be more inclined to hands-on activities as they were practising in a vocational and technical Anatolian high school and therefore this point was to be taken into consideration.

In line with this research question, the analysis of the cultural (biology and chemistry) course teachers' responses also indicated that students could not transfer their math skills into their courses, and low awareness was found as the unseen strings among the courses. Difficulties were experienced in the *comprehension of the problems, powered numbers, and mathematical calculations*. It is indicated that while students were more

inclined to listen and learn the topics without numbers, they lose their interest, attention, and motivation easily when it comes to numbers and even four simple operations. Despite the very simple mathematical calculations required in biology and chemistry courses, such as taking the power of a number and basic four operations or proportions, students could not give correct answers because of comprehension problems of terms, questions, and the high anxiety experienced when they encounter numbers. The analysis results revealed that students experienced difficulties and could not transfer what they learnt in mathematics, particularly in the exams, due to not comprehending the terms, concepts, and questions.

For instance, they know the concept 'powered number', but they do not understand what it means or why we take the power of a number. First, I try to teach the logic behind and then turn back to my own biology issues [Cct 1]

The analysis refers to issues such as *misconception of cultural courses* at vocational high schools resulting in being taken for granted and failure at the micro-level (school); *student profiles* mostly consisted of students with *low motivation, low attention span, low self-esteem, easily gets bored, and prejudiced against mathematics*.

Students mostly think that in this school cultural courses have a minimal effect; therefore, both the cultural courses and teachers are taken for granted. They do not want to learn these lessons. They say, 'teacher if I could do this, I would not come to this school' or 'why am I learning this?' To some extent, they are right! It is quite difficult and redundant for them. [Cct 1]

...when math comes onto the scene, students with low mathematical abilities get bored because they are not able to grasp and they give up then move away in a minute in the lesson. They already believe that they cannot do maths. [Cct 2]

The responses indicated that students were bringing barriers to learning cultural courses such as mathematics, biology, chemistry, etc. They believed that they could not achieve those courses and would not effectively contribute to their future career. Hence, the students did not show any interest or put extra effort to learn the cultural courses better. In this respect, the following analysis results yielding *implementation of the same curriculum, using the same textbooks* with other general Anatolian high schools of which the aim is greatly different, were seen as primary handicaps by the cultural course teachers.

I think there is a big problem in the textbooks. We use the same textbook and curriculum with the Science high schools. It means you try to raise students with drastically different placement scores with the same method. Latin concepts already make science courses heavier. Then it is natural to hear students saying, 'teacher, what do those concepts (such as hemolysis, meiosis, mitosis) have to do with being a waiter/waitress or manager in a hotel?' [Cct 1]

The analysis of the cultural course teacher responses also underlined the issues of *curriculum coverage* which frames teachers' creativity and leads them to enforce the written curriculum (Glatthorn, 2000) as it is rather than enacting a contextualised curriculum.



If I teach addressing the good students, I lose the lows, if the vice versa, the good ones. The curriculum is set, the yearly plan is set, and I have to finish it. The system is to be changed. [Cct 1]

The third research question probed for the thoughts and opinions of the graduates to uncover whether they were able to transfer the math skills they gained at school. Following the six individual interviews, the analysis yielded those graduate students were aware that they were using mathematics in a wide span, such as making a living, investing, and *planning a budget*. Students in F&B defined the enhancement of mathematics into their vocations as gaining *practicality* and *faster promotion*. In contrast, the A&T students gave various in-depth information and defined the enhancement of mathematics through concepts such as *making decisions for a business*, *reducing failure probabilities*, *profit and loss calculations*, and *keeping financial accounts* in carrying out their jobs. In other words, the concepts emerging in A&T were remarkably different from that of F&Bs.

Well...While quantities and ratios are important for F&B, for us (A&T), percentages were of quite importance, for example. If they showed us how to use those topics relevant to our departments, maybe for four or six hours a week, with different ways like visuals, smart boards I don't know... We could have used math better. [Gr 6]

As a result, while graduate students did not define themselves as efficient users of mathematics, they referred to different needs in their departments and that different teaching methods would aid in promoting their abilities in using mathematics in their fields, which were overlapping with the results of the student focus groups in that they had different needs.

As is cited by Hurst (2007), connecting students' mathematical knowledge to other contexts is a special type of teaching and is a way of helping students recognise similar situations in the future where they might use approximately the same or related relevant processes. To this effect, the students' inadequacy of setting relevance among courses in this special context may need consideration. Additionally, the call for constructing the curricula responding to differing needs also seems to be an issue for those stakeholders.

Considering supervisors as stakeholders of crucial value as they have the chance to monitor students in internships, the interviews with three supervisors helped shed light on whether the students could transfer their math skills into the field, which answers the fourth research question. The analysis of the transcriptions revealed that math skills were important for the job.

The students good at maths get used to the job quite fast, they do not cause trouble at all. They are good at quantities and recipes, and it is important for being successful in this sector. I do not want to think the vice versa... [Sp 2]

However, in transferring math skills to real-life experiences, such as internships, students' actions were observed as *limited* by the supervisors. Yet, this is defined as the case for the first year of the internship. The most outstanding concept regarding the research question is *gaining practice*, as the students are found more agile and competent the

following years of the internship. In this respect, the supervisors and vocational course teachers in-depth interview results overlap largely in that they merge into the fact that those students learn better via learner-centred instructional methods such as *learning by doing* and *hands-on activities* rather than teacher-centred instructional methods.

Actually, it is about internship. You know they learn by doing. The second-year they come more prepared and skilful. [Sp 1]

Finally, parent interview results analysis concerning reaching in-depth information of their opinions about the contribution of math skills into students' daily lives, the data revealed informative concepts such as mathematics as a means of equipping students with *compare and contrast skills, making a budget, consciousness in saving, expenditure, symmetry, reflection on character, gaining high self-confidence* and overall *responsibility* at home and work.

At the end of 11<sup>th</sup> grade, he was able to control his expenditures. I did not give him any money. He got the ability to make a living with the money he earned in his internship. To my surprise, he even had a saving account. I think he was able to do the math of his life day by day. [Pr 3]

Even if the maths he learns does not reflect on making calculations with numbers, it reflects onto his character in his personal life. He calculates, shapes his personal relationships very well. I think that's maths. [Pr 4]

Furthermore, the relations to students' prejudices and fears against learning mathematics were also mentioned by parents. Overlapping with teachers' views it was revealed that students in that specific school were more focused on applied learning and hands-on activities than abstract theoretical concepts, which they experience difficulties understanding. Sasongko and Widiastuti (2019) stated that learning via practise rather than theory is more prevalent in achieving vocational education goals. In line, the resolution suggested by Said (2018) and McNeir (1994) concludes the significance of applied learning in bridging the gap between academic and vocational education.

## Conclusions and Implications

In light of the results and discussions, it can be concluded that from the perspective of students, administrators and mathematics teachers that the implementation of the curriculum, to a large extent, fails to respond to the context of Tourism and Hotel Management High School. It is understood that though daily relevancies are set to an extent during the basic mathematics course, relevance to the students' vocations seems to be out of the school's agenda. The failure to set vocational relevance in delivering the BM Curriculum was mainly found to stem from the common top-down curriculum sent by MoNE to all Anatolian high schools. Yet, their aims are almost entirely different, and they host students with different characteristics and needs. Compared to the needs of the students in this school, the existence of irrelevant content in the curriculum seems to produce another problematic issue in setting vocational relevancies. Additionally, the District National Directorate's (mezzo-level) demands and expectations regarding the

number of students entering the university at each school seemed to have put big pressure on teachers and administrators. Therefore, it can be concluded that the university-oriented performance assessment approach of the schools at the district level might have inhibited schools from focusing on students' needs and searching for ways to set vocational relevance in the delivery of the curriculum.

Regarding the transference of math skills into vocational and cultural courses, the combined perspective of cultural and vocational course teachers, graduate students and supervisors revealed that students to a large extent were not able to transfer their math skills into the other disciplines or their vocations. The major reasons referred to as the need for more applied learning, hands-on activities rather than an abstract way of teaching, students' prejudices, learned helplessness, and student characteristics are among the most highlighted insights that call for consideration.

Furthermore, based on the insights gained out of the parents' interview results, parents viewed mathematics as an enhancement of students' characters. They also stated that it allowed them to gain responsibilities for work and life, which are the far ends of the curriculum. Last but not least, it could be concluded that Stake's Responsive Evaluation Model was fulfilling the purpose of the study to reach a pluralist view by giving voice to as many individuals as possible to uncover whether the curriculum under interest was responding to the needs of this specific context.

### **Practical Implications**

The data analysis and the overall study results yielded rich insights and implications for decision-makers and stakeholders. Below, the practical implications are presented from a macro to micro-level perspective corresponding to implementation and the top-down execution of BM Curriculum in this specific context. Concerning the implications at the macro-level, there is a considerable amount of data regarding the need for constructing relevant curricula responding to the needs of tourism and hotel management Anatolian high schools. The data analysed has put forward that mathematics teachers, administrators, cultural course teachers, vocational course teachers, and students meet at a central point that the curriculum does not address the audience's needs in this specific vocational and technical Anatolian high school and overlap with the establishments' goals. Additionally, the language used in the curricula was not relevant to the target group. That is, the data analysed in this research implied that the content, the language used, and the goals (objectives) of the curriculum for each type of vocational high school more or less differ from each other. Therefore, the results underline that what a student needs in a tourism and hotel management vocational and technical Anatolian high school in mathematics is different from those studying in a general Anatolian or Science high school.

Moreover, the analysis of vocational teachers' responses also implied that students' needs could differ from one vocational high school to the other. In line with the data analysis, it can be said that the institutions' goals play an important role in what students

need. Therefore, another crucial implication for the decision-makers can be to take decisions accounting for the uniqueness of each type of vocational high school as each serves different goals.

Another implication can be referred to the mezzo-level. Comparing vocational high schools and schools specifically established to prepare students for the university entrance exam causes great pressure on vocational high schools. The aim is to raise intermediate staff for the concerned sector, not for the high-stakes exams. This causes vocational high schools to lose track and achieve neither their establishment goals nor their ability to compete with other schools. Therefore, it can be suggested to search for and create new alternative methods to assess the achievement of vocational high schools. Besides, at macro and mezzo-level, in-service teacher training can be mentioned as another implication to be considered. Based on the findings, the cultural course teachers were non-familiar with the departments in the vocational and technical Anatolian high school they were teaching and needed orientation. The statements of the students and vocational teachers gave insights that when cultural course teachers are assigned from other schools to teach in a tourism vocational and technical Anatolian high school, they experience difficulties in teaching. There could be many reasons for this case. Yet, according to insights, teachers experience difficulty giving examples, providing explanations using the context (hotel) the students work at and creating questions relevant to the students' departments as they do not know much about how the hotels run or how people work there. It can be suggested that the case of cultural course teachers may act as an inhibition to contextualise learning and teaching. Therefore, based on the results, it can be suggested to give orientations to cultural course teachers at schools or in-service education in the districts that would enable them to adjust their teaching according to the needs of that specific group of students.

At the micro-level, the implications are related to the implementation of the curriculum in the field. The insights gained from the study suggest that the teacher groups should set a sound communication among each other. Hence, the data implied that teachers need to negotiate both before the academic year to arrange the flow of the common topics and set a reasonable flow during the academic year that would enhance each other's work and during implementation to find solutions for the problems. This analysis provided a basis for the practitioners in the field with insights that would be helpful as "providing vocationally relevant vocabulary, providing the meanings and explanations of the concepts they teach, using jargon relevant to students' departments in preparing materials, contextualising teaching, simplifying the way of teaching, and using more applied ways to teach".

### **Future Implications**

Though the study cannot be replicated as it is a case study design, the methodology would give insights to future studies. The results have rich data revealing the case through the lens of different perspectives. This study served to give voice to varied



stakeholders and gave crucial insights at macro, mezzo, and micro-level implementations of the curricula. Therefore, more studies are needed to improve these types of schools with different needs to communicate the problems in implementing the curricula. This study was conducted in a tourism vocational and technical Anatolian high school, yet there are many vocational high schools with different needs such as Fine Arts, Industrial and Health, and Sports. Additionally, further studies on mathematics or different subjects would support and give insights to implementing and constructing the curricula for those schools. Furthermore, the results derived from such studies are reflecting the ecological site of the implementation. Therefore, future studies would help schools reflect on and initiate action research to improve their current conditions.

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