Educational Studies in Science and Mathematics

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Edited by

Lütfiye Özalemdar

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PREFACE

“Educational Studies in Science and Mathematics”, which was written by authors who are experts in their field, is a scientific book aiming to contribute to science and mathematics education. The book consists of seven chapters.

The first chapter, *“Epistemology in science education research: A journal content analysis from 2005 to 2016”,* is a content analysis of epistemology in science education research.

The second chapter, *“Analysis of mathematics teacher candidates’ processes for designing model eliciting activities”,* examines the competencies of elementary school mathematics teacher candidates to design modelling activities appropriate to the design principles of model elicitation.

The third chapter, *“Assessing the level of environmental sensitivity by gender”,* analyses the environmental awareness levels of Year 9 students and whether these awareness levels vary by gender.

The fourth chapter, *“Analysis of university students’ understanding of probability distribution”,* describes research intended to determine economics students’ understanding of probability distribution – a key skill for students in their career in terms of correctly modelling and making statistical analyses of complex data.

The fifth chapter, “*Investigation of graduate theses on technological pedagogical content knowledge (TPACK): The case of Turkey”,* examines post-graduate theses on technological pedagogical content knowledge (TPACK) in Turkey, to show the trends in this field and to make suggestions for future research.

The sixth chapter, *“Analysis of mathematical modelling skills of primary mathematics teacher candidates for the traffic lights problem”,* examines the ways that elementary school mathematics teachers solve the “Traffic Light” problem, an example of theoretical modelling.

The seventh chapter, *“Elementary school students’ reasoning skills: A meta-analysis”*, describes a meta-analysis study on elementary school students’ reasoning skills.

This book contains studies that deal with educational topics including epistemology, theoretical modelling, environmental sensitivity, probability distribution, technological pedagogical content knowledge, model eliciting activity, and reasoning skills, while allowing the reader to look at science and mathematics education through different lenses.

I would like to thank all authors who have contributed to the creation of this book, and also particularly Assoc. Prof. Ömer Kürşad TÜFEKCİ for his significant contributions to the process through his valuable opinions and moral support.

Finally, I wish to express my infinite gratitude to both my beloved mother as well as to my dear late father for all they have done for me.

Editor:
Lütfiye ÖZALEMDAR

CHAPTER I

EPISTEMOLOGY IN SCIENCE EDUCATION RESEARCH: A JOURNAL CONTENT ANALYSIS FROM 2005 TO 2016

YURDAGÜL BOĞAR[1]

1. Introduction

The area of epistemology has been the focus of interest for many educational researchers since the early 1990s (Qian & Pan, 2002). This phenomenon, which mainly refers to the nature of knowledge, is the main topic of this study. Epistemology also questions how we acquire the knowledge that we have. Helping students grasp the very nature of scientific knowledge is one of the most important goals of science education. By understanding this knowledge, students get to participate in science learning activities consciously both now and in the future (Carey & Smith, 1993; Kittleson, 2006). There are many recently-published articles in the literature that deal with epistemological understanding of the construction and evaluation of scientific knowledge (National Research Council, 1996; Hofer & Pintrich, 1997; Conley, Pintrich, Vekiri, & Harrison, 2004; Sandoval, 2005; Kittleson, 2006; Deng, Chen, Tsai, & Chai, 2011). After a review of the literature, however, it was found that no content analysis study has been published recently. Motivated by this, we have carried out the content analysis study presented here. Our aim is to conduct a content analysis on epistemology in science education research, and we look into publications from 2005 to 2016 in four science educational journals. This study will help to us show what those who have

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done research in epistemology in science education endeavoured to achieve and what they actually achieved. Furthermore, it will be helpful for determining whether, how and to what extent epistemology in science education has been put into practice.

2. Method

In this study, we use content analysis to examine epistemology in science education research. Prior to the literature review, the following criteria were used to select the studies to be included in our research.

Criterion 1: Studies must have been conducted between 2005 and 2016.

Criterion 2: Studies must have been published in one of: Journal of Research in Science Teaching (JRST), Journal of the Learning Sciences (JLS), Science Education (SE) and Studies in Science Education (SSE).

3. Search Procedure and Data Sources

Our literature search is based on the following four leading journals that are related to epistemology in science education: JRST, JLS, SE and SSE. The rationale for choosing these four journals was that they have high impact on science education research. Secondly, they are among the most cited journals in the science education field. Because our focal point was original research contributions, we excluded all book reviews, replies, errata and editorial materials. In addition to this, a manual search was conducted in JRST, JLS, SE and SSE. We used the terms "*epistemology", "epistemological beliefs", "epistemology in science", and "epistemology in science education research"* when searching the journals. This limited the number of articles retrieved, and we found the most relevant ones to our study. In total, 45 studies met all of the criteria, and the requisite data necessary for content analysis were collected for each of them. The relevant articles were analysed based on the following characteristics: publication source of the study, year of the study, participant of the study and research design.

4. Results

Epistemology articles published in JRST, JLS, SE and SSE from 2005 to 2016 were analysed. A descriptive analysis of the study is shown in Table 1.

Table 1: Epistemology studies in JRST, JLS, SE and SSE

Publication Source of the Study	Year of the Study	Participants of the Study	Research Design
JRST	2006	College students	Qualitative
JRST	2007	Elementary teachers	Qualitative
JRST	2010	College students	Quantitative
JRST	2011	Middle school students	Qualitative
JRST	2013	Registered users on citizen science project's web site	Mixed method
JRST	2013	High school teachers	Qualitative
JRST	2013	High school students	Mixed method
JRST	2013	High school students	Mixed method
JRST	2014	Secondary science teachers	Qualitative
JRST	2016	No specific participant due to being a review study	No specific design due to being a review study
JRST	2016	Graduate students	Qualitative
JLS	2006	Middle school students	Qualitative
JLS	2007	Elementary, middle and high school students	Mixed method
JLS	2009	No specific participants due to being a response study	No specific design due to being a response study
JLS	2009	No specific participants due to being a response study	No specific design due to being a response study
JLS	2010	College students	Qualitative
JLS	2011	Elementary school students	Qualitative
SE	2005	No specific participants due to being a book review study	No specific design due to being a book review study
SE	2005	Elementary and middle school students	Mixed method
SE	2005	Secondary science teachers	Qualitative
SE	2006	Elementary, middle and high school students	Qualitative
SE	2006	Research chemists, research trainees, high-school, undergraduate, and graduate chemistry students	Qualitative
SE	2007	Science teachers	Mixed method
SE	2008	Middle school students	Qualitative

Publication Source of the Study	Year of the Study	Participants of the Study	Research Design
SE	2009	No specific participants due to being a development of a techno-epistemology framework study	No specific design due to being a development of a techno-epistemology framework study
SE	2009	Elementary, middle and high school students	Qualitative
SE	2010	Indigenous communities	Mixed method
SE	2010	College students	Qualitative
SE	2010	No specific participant due to being a response study	No specific design due to being a response study
SE	2011	Elementary school students	Qualitative
SE	2011	College students	Mixed method
SE	2011	Elementary school students	Mixed method
SE	2012	High school students	Qualitative
SE	2012	Elementary teachers and their students	Qualitative
SE	2012	Elementary school students	Qualitative
SE	2014	No specific participant due to being a review study	No specific design due to being a review study
SE	2014	No specific participant due to being a review study	No specific design due being a review study
SE	2014	No specific participant due to being a review study	No specific design due to being a review study
SE	2014	No specific participant due to being a review study	No specific design due to being a review study
SE	2014	No specific participant due to being a review study	No specific design due to being a review study
SE	2014	Secondary science teachers	Qualitative
SE	2016	Middle school students	Qualitative
SSE	2012	Middle school students	Qualitative
SSE	2016	No specific participant due to being a review study	No specific design due to being a review study

All of the published papers in JRST, JLS, SE and SSE between the years 2005 and 2016 were analysed for whether epistemology was covered or not. As seen from Table 1, there were 44 research articles that met the researchers' criteria for epistemology in science education research.

Table 2: Number of epistemological studies in selected journals from 2005 to 2016

	Year											
Publication source of the study	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
JRST	0	1	1	0	0	1	1	0	4	1	0	2
JLS	0	1	1	0	2	1	1	0	0	0	0	0
SE	3	2	1	1	2	3	3	3	0	6	0	1
SSE	0	0	0	0	0	0	0	1	0	0	0	1
Total	3	4	3	1	4	5	5	4	4	7	0	4

Table 2 shows that there were 11 relevant articles published in JRST, 6 articles published in JLS, 25 articles published in SE and 2 articles published in SSE. We can say that the percentage of articles related to epistemology within each journal is different, with SE as the highest of all

(57%) and JRST, JLS and SSE significantly lower (25%, 14% and 4%, respectively). Moreover, Table 1 demonstrates that 21 studies were conducted with students, consisting of elementary, middle, high and college students. Of these studies, 5 were published in JRST, 4 were published JLS, 11 were published in SE, and only one was published in SSE. So, we concluded that the majority (47%) of the studies on students' epistemologies were investigated by researchers and the majority (53%) of the studies were published in SE. As seen in Table 2, between the years 2005 and 2010, there were 20 articles published; between 2011 and 2016, there were 24 articles. This trend indicates a steady increase in the amount of research reported on epistemology in the last six years. However, in 2015, there were no studies on epistemology in the four science education journals. In addition, the most studies were published in 2014. Furthermore, the same number of studies was published in 2010 and 2011.

According to Table 3, most of epistemology studies used the qualitative method. As shown in Table 3, there were 22 qualitative research, 9 mixed method research and 1 quantitative research studies in total. In other words, there were more qualitative research studies than studies of any other type. In addition, Table 3 illustrates that there were 6 qualitative research studies in JRST, 3 in JLS, 12 in SE and 1 in SSE. Considering these results, we concluded that researchers mostly adopted qualitative research to analyse epistemology in science education. Furthermore, quantitative research was not commonly used to investigate epistemology in science education. Finally, there were two response studies in JLS, and one response study and seven review studies in SE.

Table 3: Summary of epistemology studies in science education research

Publication Source of the Study	**No Specific Design**		**Research Design**		
	Response Study	**Review Study**	**Qualitative**	**Quantitative**	**Mixed**
JRST	-	1	6	1	3
JLS	2	-	3	-	1
SE	1	7	12	-	5
SSE	-	1	1	-	-
Total	3	9	22	1	9

5. Discussion and Conclusions

In conclusion, researchers mostly make use of qualitative research to analyse epistemology in science education. Quantitative research is not a common approach to examining epistemology in the field of science education. Furthermore, it can be deduced that more and more epistemological studies are being done, so these studies are becoming more popular day by day among science education researchers. The results of our study might be of use and interest both to those who do research on epistemology and to other researchers whose area of interest is not principally centred on epistemology. Such researchers may perhaps be interested in argumentation, the nature of science, conceptual change, metacognition or technology. We have provided science educators with the knowledge to understand how epistemology has been studied in science education. By conducting one of the first content analyses on epistemology in science education research, we have made a contribution to the field: that is to say, the results of the study will have implications for future research. In our study, epistemological studies were selected from four published journal articles. Future researchers could include other data sources such as other journals, master theses, dissertations, unpublished dissertations, and national and international conference papers.

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Appendix 1:
Articles investigated within the scope of the study

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CHAPTER II

ANALYSIS OF MATHEMATICS TEACHER CANDIDATES' PROCESSES FOR DESIGNING MODEL ELICITING ACTIVITIES

DEMET DENIZ[1]

1. Introduction

Mathematical modelling is defined as a periodical cycle in which real-life problems are abstracted, mathematised, solved and evaluated (Haines and Crouch, 2007). The idea of modelling being used in mathematics education is based on the insufficiency of current types of problems for students interpreting mathematics and learning it in relation to real life (Erbaş, Kertil, Çetinkaya, Çakıroğlu, Alacacı and Baş, 2014). Through mathematical modelling, students no longer see mathematics as a discipline that is isolated from real life, and they are made to realise that mathematics has an aspect that produces solutions to real life problems via modelling (Ministry of National Education, 2013). Lesh and Doerr (2003) use the concept of model-eliciting activities (MEAs) instead of modelling activities (Doruk, 2010). MEAs are problem-solving activities which involve sharable, modifiable and reusable conceptual tools (e.g. models) and are different from traditional word problems (Lesh and Doerr, 2003). MEAs are not only problems that involve real life problems which students have to solve, but also maths-based activities requiring that they develop a model that can be generalised to other contexts (Lesh and Harel, 2003). There are no keywords or templates in MEAs that guide the student, as there are in traditional problems; they are complex situations that are taken from real life, which don't have a single correct answer or a single solution (Doruk, 2010; Herget and Torres-Skoumal, 2007; Kertil,

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2008). In the traditional problem-solving process, problems are closed-ended and students try to solve them by rather arithmetical operations (Boaler, 2001; English, 2006; Lesh and Yoon, 2007). In MEAs, however, numerical operations are only a step to solving the problem, and what's important is that students produce and develop their own thoughts (English, 2006; Lesh and Yoon, 2007). MEAs are intended for advanced thinking skills where others' ideas are assessed, information is synthesised, and relations and patterns are analysed. In addition, MEAs allow students to be able to use the strengths and various levels of knowledge of their classmates (Stohlmann, Maiorca and Olson, 2015). MEAs need to contain topics that are encountered or can be encountered in real life, but sometimes situations can be presented that students haven't encountered in real life or don't have experience with, so that they can gain knowledge about them (Bukova Güzel, 2016).

For MEA design, Lesh, Hoover, Hole, Kelly and Post (2000) developed six principles by revealing, testing and refining the recommendations of parents, teachers and community leaders who participated in their studies. These principles are the reality principle, the model construction principle, the self-assessment principle, the model documentation principle, the model generalisation principle and the effective prototype principle. The reality principle is based on the ability of the students to interpret the activity meaningfully according to their own knowledge and experience. Therefore, activities should be designed based on real or slightly modified real data. This principle ensures that students can interpret the activity meaningfully from different levels of mathematical ability and general knowledge (Chamberlin, 2004; Lesh et al., 2000). Fundamentally, this is focused on the question: "*Can this situation really exist in the real life of the student outside school?*" (Lesh and Caylor, 2007). In MEA, when students develop a model to help a real customer/adviser, the fact that they accept the thought that the problem arises from a real need and that they feel the need to do something for others shows the existence of the reality principle (Bukova Güzel, 2016). The model construction principle states that students need to construct a mathematical model in order to reach the solution of a problem (Chamberlin and Moon, 2005). This principle involves the symbolic explanation of a meaningful situation. That is, these activities include mathematising. Therefore, the question to be answered in the model construction principle is whether students will be aware of the need to create models in order for them to interpret what is given, what is requested, and possible solutions in complex problems (Lesh et al., 2000, p. 606). This principle focuses on the question: "*Is the problem situation given in a way that will satisfy the need to modify or enlarge the existing* *model?*" (Lesh and Caylor, 2007). The self-assessment principle states that the purpose of the problem should be clear and suitable for the students' level, and that students should be able to assess the compliance and usefulness of their own solution approaches without seeking the opinion of their teachers (Chamberlin and Moon, 2005; Lesh et al., 2000; Tekin Dede and Bukova Güzel, 2013). This principle focuses on the question: *"Will students be aware of the criteria to assess themselves when their answers are good enough? Will they be able to assess the strengths and weakness of their alternative answers?*" (Lesh and Caylor, 2007). The self-assessment principle contains information that might allow the students to select the most convenient one among alternative solutions and eliminate other ideas, because group students in MEA may have different solutions and ideas (Lesh et al., 2000). The construct documentation principle involves students revealing their own thoughts and solutions and documenting them in order to communicate to the people that the problem addresses in a way that they can understand (Chamberlin and Moon, 2005; Lesh et al., 2000; Tekin Dede and Bukova Güzel, 2013). This principle tries to answer the question: "*Will responding to the question require students to reveal explicitly how they are thinking about the situation by revealing the givens, goals, shareable and reusable?*" (Lesh and Caylor, 2007). The construct documentation principle helps teachers examine what their students are thinking about related to mathematical operations, relations and patterns during the problem-solving process. This principle makes it easier for the students to visualise and therefore reflect on their thinking (Chamberlin, 2004; Chamberlin and Moon, 2005; Lesh et al., 2000; Lesh, Cramer, Doerr, Post and Zawojewski, 2003). The construct documentation principle facilitates self-assessment since it is aimed at the documentation of learning. Therefore, this principle is related to the self-assessment principle, which requires students to assess their own solutions (Chamberlin and Moon, 2005; Lesh et al., 2000). The model generalisation principle requires students to go beyond personal tools to developing more general ways of thinking that can be used by others for similar situations (Chamberlin, 2004; Chamberlin and Moon, 2005; Lesh et al., 2000). This principle poses the question: *"Will the students realise the need for the product to be shareable and reusable?*" (Lesh and Caylor, 2007). This principle focuses on how a model that was created for similar situations will change and be generalised (Bukova Güzel, 2016). According to the effective prototype principle, the models developed by students should be as simple as possible, yet still mathematically significant. In addition, the students should be able to recall the solution when they are confronted with a similar situation in terms of construction even after a long time has passed (Lesh et al., 2000). This principle focuses on the question: "*Will the models that are developed provide a useful prototype (or metaphor) for interpreting other similar situations?*" (Lesh and Caylor, 2007).

Among the studies for designing MEAs according to these principles, Yu and Chang (2011) have analysed 16 secondary mathematics teachers' perceptions and obstacles of modelling after designing four MEAs in four groups. At the end of the study, the four activities prepared by the teachers were evaluated according to the principles of designing MEAs. Tekin (2012) prepared a document review for the compliance of MEAs designed by the teachers to the principles. Using content analysis, he analysed the designing process, the discussions with the groups at the end of the designing process, and the discussions occurring after school practices. At the start of the study, it was found that the teachers had no prior knowledge of MEA. In their studies, Tekin Dede and Bukova Güzel (2013) analysed the Obesity Problem, which was designed by four mathematics teachers, within the framework of the principles of designing MEAs. Deniz (2014) introduced the method of mathematical modelling to the mathematics teachers working in the central district of Ağrı in his study to examine whether they designed activities that are appropriate to mathematical model eliciting principles, and presented examples of activities that include the method of mathematical modelling in the literature. While it was found that MEAs designed individually by the teachers were completely appropriate to the reality and model generalisation principles, they were only partially appropriate to the self-assessment principle; compliance to the effective prototype principle was not examined. Çiltaş (2015) analysed the design processes of mathematical modelling activities designed and solved by secondary mathematics teachers. Mathematical modelling training was given to teachers who participated in the study, and they were asked to design MEAs individually. It was found that teachers had difficulty, in particular, with the "Construct documentation" and "Model generalisation" principles.

Even though there are studies analysing MEA design processes, those studies have often been carried out with teachers. This study has allowed teacher candidates the opportunity to solve modelling problems as part of a mathematical modelling class and to design MEAs. In addition, this study aims to add activities to the literature whose compliance to the principles of designing MEAs is examined in detail at the primary education level. Therefore, the purpose of this study is to examine the competencies of primary mathematics teacher candidates in designing activities that are appropriate to the principles of MEA design.

2. Methodology

2.1. Research Design

This study aims to examine the compliance of MEAs designed by primary mathematics teacher candidates to the principles of MEA design. In line with this purpose, the study uses case study design as a qualitative research methodology.

2.2. Participants

Among purposive sampling methods, the convenience sampling technique has been used in determining participants. Convenience samples are relatively less costly and practical and are easily understood for researchers (Yıldırım and Şimşek, 2008). The research was conducted by 20 mathematics teacher candidates from a mathematical modelling class, who were willing to voluntarily participate in the study.

2.3. Data Collection and Data Analysis

The research data consists of audio records of group studies during the design process and from the five MEAs designed by the teacher candidates. Descriptive analysis was used to determine compliance of the activities designed by the primary mathematics teacher candidates to the six principles that Lesh et al. (2000) developed. Audio records of the teacher candidates during the MEA design process were analysed using content analysis. In determining compliance of the activities designed by the groups that the teacher candidates created to the principles of designing MEAs, "Completely appropriate", "Somewhat appropriate", "Not appropriate" and "Not identifiable" criteria were applied, as Tekin Dede and Bukova Güzel (2013) used in their studies. The opinions of an expert studying mathematics were taken in the analysis of the data. Design activities were coded as G1 (activity designed by group 1), G2 (activity designed by group 2), G3 (activity designed by group 3) and so on.

2.4. Implementation Process

This study was carried out by teacher candidates in the final year of primary mathematics teaching and who chose the elective mathematical modelling class. These teacher candidates were provided with the necessary information related to the mathematical modelling process, types of mathematical modelling and the principles of designing MEAs for three hours every week during a seven-week period, and examples of activities in the literature were examined according to the MEA design processes and solved pursuant to the modelling cycle. Later, teacher candidates were asked to form groups and for each group to design an activity. The teacher candidates tried to design an activity for three weeks and then shared the activities that they designed with the classroom. During this process, the teacher candidates shared their studies related to the activities that they designed with the researcher, while the researcher only provided support so that they could find sources that could help them design a MEA. No class level was determined in designing activities. The work of each group of teacher candidates were recorded with a tape recorder.

3. Results

This section includes the results obtained after analysing the processes for designing activities that are appropriate to the principles of MEA design by primary mathematics teacher candidates. The teacher candidates formed groups and tried to design MEAs. Information related to the analysis of the compliance of the activities designed by the teacher candidates to the principles of MEA design is given in Table 1.

Table 1: Compliance of the designed activities to the principles of designing MEAs

	Reality	**Model Construction**	**Self-Assessment**	**Model Documentation**	**Model Generalisation**	**Effective Prototype**
Completely appropriate	G1, G2, G3, G4, G5	G4, G5		G2, G4, G5	G4, G5	
Somewhat appropriate		G2, G3	G1, G2, G3, G4, G5		G2, G3	
Not appropriate		G1		G1, G3	G1	
Not identifiable						G1, G2, G3, G4, G5

G1 activity was as follows:

Introductory Article

Effective studying methods should be known to be successful. For example, study time directly influences achievement. The brain works much more efficiently until 10 am. Tiredness is also a factor that influences success. Ten minutes of afternoon nap will allow the brain to work again. Puzzles are influential in the development of the brain. Reading develops the brain. Ten minutes of sleep is worth six hours of sleep.

At What Time Does the Brain Function Best?

7.00 am–10.00 am is the best time for learning. The mind is clear and renewed at these times.

Does Motivation Affect Achievement?

Motivation increases concentration. Someone with a higher concentration will have an easier time to focus and so learning improves. After eating, concentration falls. Therefore, studying should be avoided immediately after eating.

Is Achievement Related to the Difficulty of the Topic?

Students don't want to study a class that they don't understand. They will love studying for a class they understand. Students usually study most for classes that they understand and in which they feel like they can achieve something. Classes with a higher difficulty of topic will be understood more slowly. That's why difficulty of topic influences motivation. Consequently, it is related to achievement. The following table includes the precursors of achievement:

Table 2: Precursors of achievement

Percentage of motivation	Study time	Difficulty of topic	Tiredness	Achievement
10	6	2	4	10
55	10	4	15	

> Create a formula for Ayşe, who has started late to study for her examination late in order to make her studying more effective, so that she can achieve success in the fastest way.

Analysing the activity designed by G1, a situation in real life was addressed, an introductory article was provided relating to the situation, and the relation of the designed activity to real life was explained in detail. Therefore, it is completely appropriate to the reality principle. When the design process of this activity was examined, it was seen that the teacher candidates' efforts to design activities were appropriate to the students' level, but their activities were not comprehensible, and there is no record of the students having been told to self-assess. Therefore, it is somewhat appropriate to the self-assessment principle. A conversation between teacher candidates relating to self-assessment is as follows:

> "Teacher candidate 1: The topic that we chose is a little hard. How can we find a formula that is appropriate to this; shall we change the topic?
>
> Teacher candidate 2: Then let's make the study easier."

In this activity designed by G1, the teacher candidates are not suitable for creating a model, as it is not clear from the data what the researchers are really looking for, even though they ask for a model to be created, and it is not stated what the created model will mean. The researchers created a model of this problem in their own way; however they weren't able to explain how they created this model based on the givens, and the solution to the problem is not usable by others for similar purposes. Therefore this activity is not appropriate to the model construction and model generalisation principles. In addition, a statement that would allow the reader to provide descriptive information related to the factors influencing success was not included, thus it is not appropriate to the construction documentation principle. It is not possible to determine the effective prototype principle.

G2 activity was as follows:

> **Introductory Article**
>
> A newspaper is a publication that contains news, information, crossword puzzles and advertisements, and which is distributed generally using low-cost paper; it seeks to provide information to the public related to current events. While it can be general, it can also focus on a specific topic and it is generally published daily or weekly.

Today, newspaper publication is an area that requires large capital investment as a result of technological developments. Increased costs due to economic reasons and decreased purchasing power of readers are the leading problems that cause the written press to struggle to keep afloat.

Readiness Questions

1. Do you read a newspaper?
2. How do you find newspaper prices?
3. If you subscribed to a newspaper, how much would you like the newspaper to cost?

Newspaper Problem

The sale price of the Takım newspaper, which is published weekly and whose every issue sells 50 000 copies, is priced at TL 4. However, the newspaper needs to increase its sales price due to increased printing quality. Research was carried out among readers in order to better understand the negative impact of a price increase on newspaper sales. Accordingly, it is predicted that any increase of 25 kurus will lead 2500 people to decide not to buy the newspaper. If you were to advise the executives of the newspaper taking into consideration this information, what would you advise the newspaper prices to be set as?

The activity designed by G2 is completely appropriate to the reality principle, since the real life situation is explained in detail in the introductory article. However, when the teacher candidates' activity designing process was analysed, it was seen that they had difficulty in finding a real life problem. While designing the G2 activity, it was ensured that it was expressed in a clear way suitable for the level of the students. However, no statement was given to ensure that the problem-solvers themselves would decide to what extent their solutions for the problem situation are valid by discussion within their group. Therefore, this activity is only partially appropriate to the self-assessment principle. A conversation between teacher candidates relating to the self-assessment and reality principles in designing the activity follows:

Teacher candidate 3: There could be a landslide problem. How much forestation should be done in order to solve this problem, which occurs more often on Black Sea shores? As in, to what extent this would the problem be prevented if…