

Chapter 15

Working in a Wiki Environment: Preservice Teachers' Experiences and Perceptions: The Case of Geometry

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EXECUTIVE SUMMARY

This chapter describes a case where a class of preservice teachers used the wiki environment to discuss existing geometry lessons, improve the lessons and build new ones. The constant comparative methodology was used to analyze the experiences of the preservice teachers in working with geometry in the wiki environment and in developing their knowledge of geometry and its teaching and learning.

The case study shows that the discussion option in the wiki was used by the preservice teachers not only for discussing issues related to geometry lessons, but also for discussing issues related to psychology and philosophy. This points at the potentiality of the wiki to be a rich educational and cultural environment for students.

The wiki environment enabled student-only discussions, as well as student-instructor discussions. This implies that students working in the wiki environment can have control over their own learning. In addition, the wiki environment did not only give the preservice teachers an opportunity to develop their knowledge as learners and teachers of geometry, but as designers and builders of web sites.

The preservice teachers confronted four types of difficulties throughout their whole work in the geometry wiki environment, but they could overcome these difficulties using different means, especially discourse. Overall, the preservice teachers found that the wiki environment benefited them and appreciated the various functions which the wiki enabled.

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BACKGROUND

Wikis are used and constructed by students for various targets. Taylor (2006) described the advantages that wiki technology offers: (1) it is available 24 hours a day, (2) it is easy to navigate, search and make contributions, (3) changes, new information and successful improvisations can be quickly documented, and (4) new, revised or alternative worksheets can be attached for subsequent use by anyone. Grant (2006) described wikis as “new and powerful form of software capable of supporting a range of collaborative ventures and learning activities”. Forte and Brukman (2007) suggested that wikis could be used by students not just as a kit for writing to learn, but as a kit for public knowledge building in schools. Head and Eisenberg (2009) found that higher education students use Wikipedia as a unique and indispensable research source for conducting their researches. They added that this collaborative, community-based online source gave students a big picture and language contexts for their research projects. Head and Eisenberg (ibid) reported that in 8 out of 11 of the student discussion sessions there was a strong consensus among the students that their research process began with Wikipedia.

It can be concluded that the wiki technology serves various educational functions for teachers and students. This makes the wiki technology an option that preservice teachers can utilize to build their knowledge. This chapter will describe preservice teachers’ wiki-experiences in the case of discussing, improving and building geometry lessons, and in the case of developing their content and pedagogic content knowledge. In addition, the chapter will describe the difficulties encountered by the preservice teachers while living the experiences, how they overcame these difficulties and the benefits they found in working in the wiki environment.

SETTING THE STAGE

Wikis in Education

Wikis can support the delivery of class curriculum and projects, as well as the discussion during the process of creating and sharing knowledge (Leuf & Cunningham, 2001). Tonkin (2005) identified four categories of the wiki use in the education field:

- **Single-user:** This use allows individual students to write and edit their own thoughts. It is useful for revision and monitoring changes in understanding over a period of time.
- **Lab book:** This use enables students to peer review notes kept online by adding commentary, annotations or other additions to existing lecture notes, seminar discussions, lesson plans, etc.
- **Collaborative writing:** This writing can be carried out by a team for joint project or for research such as a group initiative, essay or presentation.
- **Knowledge base:** Through collaborative entries, students can create course content that supplements and extends delivered material.

Raman, Rayn, and Olfman (2005) examined the use of wikis in facilitating the creation of a knowledge management system. They chose the wiki technology for its following characteristics: (1) Wiki technology is easy to install (and free), (2) Wiki technology provides capability for easy access and editing, (3) Wiki technology allows a class to develop a knowledge base readily, and (4) Wiki technology can aid knowledge creation and sharing in both corporate and academic settings. Raman, Rayn, and Olfman (ibid) found that wikis can support collaborative knowledge creation and sharing in an academic environment. The factors that influence the success to provide such support

are: familiarity with wiki technology, careful planning for implementation and use, appropriate class size, and motivation of students to engage in discovery learning.

Effectiveness of Wikis as Learning Environments

Coutinho and Bottentuit Junior (2007) described a collaborative learning experience of post graduate students who attended a program on research methods in education, where the experience involved the use of wikis in advanced collaborative forms and participative assessment as part of the teaching method. They pointed out that the feedback received from students showed that wikis could be effective in learning environments; however, the evidence obtained, regarding the potential of wikis to promote learning in the zone of proximal development, was clearly inconclusive: students enjoyed working in groups, but they did not believe group work to have better quality; nor did they learned more working in teams than working individually. The researchers stated that the findings could be explained by the lack of vertical interaction teacher/student. This interaction was minimal to enable student-centered learning.

Wikis as Collaborative Educational Environments

Carr (2008) described attempts to integrate the wiki in an education course for preservice teachers. The goal of this integration was supporting nets of classroom collaborative knowledge building, in addition to building a model for authentic integration of technology in the curriculum. The preservice teachers learned in an environment of problem solving that integrated face to face learning with online learning which included the wiki. Carr (ibid) stated that the preservice teachers' responses point to intensive engagement in the wiki environment, which facilitated the group interaction and the collaborative learning. Carr

concludes that there is a need "to further work in instilling a culture of collaboration and collective knowledge creation to realize the full potential that wikis offer an educational setting" (p. 147).

Lin (2008) examined the preservice teachers' perception of the wiki, of the collaboration in the wiki environment, and of the future uses of the wiki in educational programs of teachers in elementary school setting. Fifty-three preservice teachers from three classrooms participated in the research. The preservice teachers contributed to a wiki site, which was involved with innovations in educational technology. The findings showed that the preservice teachers appreciated the collaboration characteristics of the wiki environment, its visual representation, and its capability to contribute to their projects at the individual level. Additionally, the preservice teachers expressed concerns regarding the technical limitations of the wiki, and thought that different strategies for using the wiki in their future teaching and learning could be developed.

Kessler (2009) studied student-initiated attention to form in wiki-based collaborative writing among preservice non-native speaker (NNS) English teachers. He found that the overall tendency among these NNS English teachers, when editing each other's wiki-posts, was to focus on meaning rather than form. When the teachers revised the form, they did so with some additional attention to the content, so this revision of form was not just an isolated incidence of error-correction. The teachers deferred to meaning, design and style rather than grammatical errors. When asked to explain their behavior, the teachers responded that they did not attend to grammatical errors because they had no problem understanding the meaning of the sentences. The wiki environment, thus, was appropriate as collaborative educational environment, but not for the 'form' aspect of language. This can be explained by the wiki being a public source of knowledge and not a source associated with language and literature.

Grant (2006) described a wiki project in which three Information and Communication Technology 9th grade classes took part. The teachers assigned students to random groups of between six and nine students, each with their own separate wiki. The students were required to work in their groups on a history-based research project regarding innovations in technology since 1950. They were asked to present their project in the wiki. Grant (2006) stated that the students worked on their own wiki pages, and very few edited material on others' pages. The interviewed students agreed that it was better to write one's own page rather than edit someone else's; however, the students did consider commenting on each other's design of the wiki pages as acceptable and legitimate practice, and did so. The author concluded that knowledge-building network did not arise in this experiment, and explained that this happened because the students imported practices of individualized written texts and assignments from their school community. These findings point to the importance of watching the work of students in new technological environments, so that they don't import to it their previous learning practices.

Wilkinson and Huberman (2007) pointed to the following measures that serve to compute the collaboration in editing an article in wikis: (1) the number of edits on an article, (2) the number of contributors, (3) visibility or relevance of the article, and (4) age of the article. Meishar-Tal and Tal-Elhasid (2008) stated that in educational wikis, the number of contributors should not be taken into account when measuring collaboration, and instead the relative diversity of contributors should be taken into account. They defined relative diversity as the ratio between the number of actual contributors and the number of potential contributors. For example, potential contributors could be the number of group members who work on a wiki article. Meishar-Tal and Tal-Elhasid added to the previous measures another measure, which they called 'intensity'. They defined 'intensity' as the number of edits that the contributors performed;

this should be taken into account proportionally to the relative diversity of the collaboration.

Wikis as Environments for Educational Dialogue or Interaction

Cohen (2009) described the process of creating a mathematical dialogue by means of a collaborative editing of a wiki document about the mathematical term 'function'. She reported that participation of the practitioners who collaborated in editing the term contributed to an improvement of the information about the term "function".

Aharony (2008) found the following types of interactions in the discussion section of a wiki that was constructed by 19 undergraduate second-year students who participated in an information-management academic program: courtesy, instructor's comments (supportive comments, style and bibliography, substantive comments), students' constructive comments (structure and bibliography comments, clarification, expanding the assignment, deep comments), and students' response (communication with the instructor, emotional reaction, technical and structural comments, appreciation, direct response to other students' comments, substantive deep comments).

CASE DESCRIPTION: THE PRESERVICE TEACHERS' WIKI EXPERIENCES

Stages of the Preservice Teachers' Wiki Experiences

The experiences of the preservice teachers in this case could be generalized to fit all learners who work in the wiki environment, examining, evaluating and building learning materials and lessons. The preservice teachers' experiences consisted of three stages: (1) reading and evaluating existing geometry lessons and suggesting, in the wiki discussion sections, improvements for the lessons, (2)

carrying out the suggested improvements, and (3) writing new geometry lessons. Described below in detail are the preservice teachers' experiences in each of the three stages.

Evaluating Existing Geometry Lessons and Suggesting Improvements

In this stage the preservice teachers were required to visit sites of geometry lessons built by preservice teachers in the previous year to evaluate the sites and suggest improvements for the lessons. Each preservice teacher was required to evaluate at least two lessons and write suggestions for improvement in the discussion section of the same lesson. The preservice teachers were also required to give their opinion regarding the suggested improvements. Additionally, each one of the preservice teachers was required to write feedback regarding at least three suggested improvements. The goal of the feedback was to discuss the suggested improvements and agree that they actually improved the lessons. An electronic forum was opened for the preservice teachers to put in it the links to the wiki pages that contained the improvements suggested. The goal of this action was to facilitate the discussion of the whole class because the wiki lessons' web pages of the previous year's students numbered more than one hundred.

At the beginning, the preservice teachers suggested technical improvements. This led to a requirement to suggest improvements for geometric content or geometric pedagogic content. Doing so, the preservice teachers also suggested improvements related to pedagogic knowledge. Described below are the improvements which the preservice teachers suggested for the technical aspect of the lesson, the geometric content aspect, the geometric pedagogic content aspect, and the pedagogic knowledge.

Improvements Related to the Technical Aspect of the Lesson's Site

The following improvements were the most common suggestions of preservice teachers: (1) changing the font's size or color, (2) making the font bold or underlined, (3) adding a background to a web page or replacing a background with another to better suit the color of the text, (4) adding a link to the previous or the following web page, (5) replacing pictures that represent bullets with ordinary bullets, (6) deleting a picture which has no relation with the text that it accompanies or that has a decorating function, and (7) adding a space between two subsequent titles.

Improvements Related to the Geometric Content Knowledge

The preservice teachers suggested different improvements that could be related to the geometric content knowledge. The most common suggestions were: (1) changing the definition of a geometric concept in order to fulfill one or more of the definition criteria, (2) describing all types of a geometric shape, (3) giving equivalent definitions of a geometric, (4) correcting a sentence to better fit a geometric relation (e.g., adding a missing multiplication sign between 'length' and 'width' to represent the area of a rectangle), and (5) adding an applet which describes another aspect of the geometric object or topic.

Improvements Related to the Geometric Pedagogic Content Knowledge

The preservice teachers suggested different improvements that could be related to pedagogic content knowledge: (1) giving examples of a definition, (2) giving examples of different shapes that represent a geometric concept (e.g., giving the concave and convex types of a rhombus), (3)

writing questions of different levels keeping in mind Bloom's taxonomy, (4) giving alternative definitions in order for students to understand, (5) writing a sentence which clarifies a preceding or a following sentence or geometric concept or relation, (6) correcting a sentence verbally so that its meaning becomes clearer (e.g., to rewrite the sentence "the product of the two areas" into "the product of the triangle area and the square area"), (7) adding a relevant shape that clarifies a geometric concept or statement, (8) replacing a picture with another picture which is more relevant to the mathematical topic (e.g., replacing a picture of a real life cube with another picture to suit better the cube geometric concept), (9) adding an applet which helps the student to understand a mathematical topic, and (10) adding a summary to a previous mathematical topic, so that the new mathematical topic becomes more accessible to the student.

Improvements Related to Pedagogic Knowledge

The preservice teachers suggested different improvements that could be related to pedagogic knowledge: (1) writing in detail, on the first page of the lesson, the exact components of the lesson and not just writing: part I, part II, etc., (2) adding an illustrating picture which is not a geometric shape to make clearer the non-mathematical content of a story in the lesson, (3) changing an illustrating picture which is not a geometric shape to fit better the non-mathematical content of a story in the lesson, (4) making an illustrating picture, which is not a geometric shape, smaller to give sufficient attention to the verbal text, (5) correcting the dictation of a word to make a sentence meaning clearer to the reader, (6) adding a verbal text which describes the non-mathematical phenomenon of the problem, (7) re-writing a sentence to make its meaning clearer, (8) changing the title of a wiki page to fit the non-mathematical content of the page, (9) changing a verbal text

of a non-mathematical content to make it more coherent, and (10) adding a verbal text which explains the importance of a mathematical topic in our daily life.

When a preservice teacher gave a suggestion for improvement, the discussion stage began. Other preservice teachers gave their opinions about the suggested improvement. An example of a discussion on each type of the previous improvements follows.

A Discussion on a Technical Aspect of a Lesson's Site

The page formatting:

"I didn't like the page formatting, especially the colors and the pictures. I think the page contains too many pictures." (Jasmine)

Colors and pictures:

"Why didn't you like the colors Jasmine, and why do you think the pictures are too many?" (Instructor)

Yes, the colors:

"I agree with Jasmine that there is a problem with the colors. In fact there are too many colors in the page. To say the truth, when I entered the site I didn't feel I want to continue reading the text." (Malak)

To Malak, the color issue:

"Malak, why do you think the page colors made you stop reading?" (Instructor)

Explaining the issue of colors and pictures:

"In my opinion, colors have an important role in the page design, especially if the lesson is designated for school students. How can we use

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the yellow color if we want to show the site on a big screen? Nobody will be able to follow the text. Add to this that we may have students with vision impairment who will suffer from a web page whose colors don't fit each other or don't assist easy reading. Regarding the pictures, there are four pictures that say 'Welcome' to the visitor. What is the need for so many 'welcomes'? It is better if we leave just one picture and add another one which illustrates the topic of the lesson." (Jasmine)

Explaining the issue of colors:

"It is not the number of colors which annoys me but the colors mix and how much they fit each other. If they don't fit I will not be able to bear the sight of the page and will stop reading. I think it is a psychological matter which exists in each of us." (Malak)

We see that one preservice teacher suggested improving the formatting of a wiki web page regarding its color and number of pictures which are not mathematical. The instructor and another preservice teacher responded to the first preservice teacher suggestion of improvement, where the second preservice teacher agreed with the point of view of the first one, while the instructor discussed with them their claims.

A Discussion on an Issue Related to Geometric Content Knowledge

The rhombus definition:

"The rhombus definition isn't correct. I suggest replacing it with a better one. (Sami)

"Wrong!! Why?" "I do not understand why Sami says the rhombus definition is incorrect. It is all right for me." (Amir)

Wrong definition of the rhombus:

"What is wrong with the rhombus definition Sami?" (Instructor)

A reason for the incorrectness of a definition:

"The rhombus definition does not satisfy the criterion about the minimal properties." (Sami)

Criterion of minimal properties:

"I understand this criterion, but why doesn't the rhombus definition satisfy it?" (Amir)

Edges not angles:

"It's enough to describe the relations between the edges of a rhombus; the relations between its angles result from the relations between the edges." (Sami).

Agreeing with Sami:

"Of course, I now remember that the relations about the angles of a rhombus come later after we define the rhombus. Thanks Sami for explaining."

A correct definition of the rhombus:

"So how do you suggest defining the rhombus Sami?" (Instructor)

Suggesting a definition for the rhombus:

"Here is a possible definition: A rhombus is a quadrilateral which has a pair of two equal adjacent edges and the other two edges are equal too."

In the previous discussion, the center of the discussion was on the correct definition of a geometric shape, in our case a rhombus, where the discussion was almost entirely between two preservice teachers, and the instructor interfered only to inquire about the first preservice teacher's

claim, and at the end to require the same preservice teacher to suggest a better definition.

A Discussion on an Issue Related to Geometric Pedagogic Content Knowledge

Exterior angles:

“I read what is written about exterior angles. I think the written text and stated geometric relations are not enough for the students to understand the exterior angles deeply.” (Suha)

Drawings:

“I agree with Suha and at the same time want to point at the absence of enough geometric shapes that show one exterior angle of a triangle, the six exterior angles of a triangle, the three exterior angles of a triangle that are generally counted when referring to the triangle exterior angles, exterior angles of a quadrilateral, etc.” (Lama)

Why so many drawings:

“Lama, don’t you think that the wiki page will be stuffed then with pictures? The students then will not be able to read the text.” (Souna)

Not enough information:

“Suha, what other information you want to include about the exterior angles of a polygon?” (Instructor)

Which exterior angles?

“Souna, which exterior angles you think are enough for the students in order to know the concept of the exterior angles?” (Instructor)

A suggestion:

“I agree with you Souna, so I suggest dividing the text about exterior angles of a polygon, so no page will get stuffed.” (Lama)

Two exterior angles:

“I think it is enough to give two shapes: a shape which shows a triangle with one exterior angle and a shape which shows the three counted exterior angles of a triangle.” (Souna)

Important property – theorem:

“There is no mention for the sum of the exterior angles of a polygon. The students should know that the sum of the exterior angle of a polygon is 360 degrees for all polygons.” (Suha)

In the previous discussion three preservice teachers were involved together with the instructor. There were suggestions for improvements, agreements and disagreements, in the way to change part of the geometric lesson to make it better for the learning of the students.

A Discussion on an Issue Related to Pedagogic Knowledge

Importance of a topic:

“There is no description of the importance of the topic of lines and straight lines, so students may not give enough attention to the topic.” (Salma)

Old days:

“When we learned about lines and straight lines back in the elementary school nobody told us about the importance of this topic.” (Lama)

Why talking about the importance of a topic:

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“We too didn’t learn about the importance of any geometric topic, but this is the reason why we didn’t like geometry at that time.” (Salma)

Describing the importance of a topic:

“Do you think we should describe the importance of every topic or is it enough to describe the importance of geometry?” (Lama)

Both:

“Both are most important, but describing the importance of every topic is especially beneficial. When we know the uses of the topic, for example in real life, we make more effort to learn it, and as a consequence we benefit from learning it”. (Salma)

Just two preservice teachers participated in the previous discussion, discussing a pedagogic issue, which emphasized the importance of every topic that the students learn, in order to make them like the topic more and want to learn it.

CARRYING OUT THE SUGGESTED IMPROVEMENTS

After ten days of suggestions regarding the improvement of geometric lessons that were written in the previous academic year, ten days of actual improvements started. The preservice teachers changed the lessons according to their suggestions and discussions. Only changes which were agreed upon were carried out. The actual improvements were done individually.

Writing New Geometry Lessons

Writing new geometry lessons lasted for one month. The preservice teachers are required every year to write geometry lessons that emphasize new aspects of geometry learning. The preservice teachers whose experiences are described in this

case wrote lessons that emphasized history, art, and geometric trips. The preservice teachers were given the freedom to write the lesson individually or in pairs.

Benefits of Working in the Geometry Wiki Environment

The preservice teachers mentioned many benefits of working in the wiki environment, discussing, improving, and writing geometry lessons:

- Seeing and discussing geometry lessons that were written in previous years by preservice teachers gave us a picture of the components of geometry lessons.
- Seeing and discussing geometry lessons developed our geometry knowledge.
- Seeing and discussing geometry lessons made us more sensitive to the learner.
- Writing new geometry lessons will help future preservice teachers and inservice teachers in their teaching.
- Working in the wiki environment, we deepened our knowledge regarding definitions and methods of proving in geometry.
- Working in the wiki environment, we performed the first steps of writing geometry lessons.
- In the wiki environment we worked as teachers.
- Working in the wiki environment, we mastered a new tool which could be used for teaching.
- Working in the wiki environment, we knew an electronic tool which is suitable for building geometry and mathematics lessons.
- Working in the wiki environment takes time and effort but it is fun and enjoyable.

Advices for Geometry Learners Who Will Work in the Wiki Environment

The preservice teachers stated the following pieces of advice for preservice teachers who come to work geometrically in the wiki environment.

- Master first the wiki language. This will save your time and facilitate your work.
- Discover what preservice teachers from previous years wrote, and try to write geometry lessons that avoid the negative aspects of their lessons and follow the positive aspects of those lessons.
- Know that the wiki language is good for mathematical equations too – of course geometrical equations included, so there is no need to include mathematical equations as images.
- Don't include images just for decoration. Decorative images distract the attention of the student.
- If you work in pairs try to agree between each other what each one should do, so the work will be done in due time and no problem will occur between you.
- If you confront any difficulty in building your own site consult a preservice teacher from a previous year or the instructor. Almost always they will have an advice for you.
- If you want to write what is similar to something that you have seen in the wiki, and you do not know how to do that, you can discover the wiki way to do that by going to “view source” in the main menu or to “edit this page”.
- Don't put a space at the beginning of a raw unless you want a sentence to be inside a rectangle.
- When you finish writing or editing a wiki page don't forget to save it. If not, your work will get lost.

CHALLENGES FACED BY THE PRESERVICE TEACHERS IN THEIR WORK IN THE GEOMETRY WIKI ENVIRONMENT

The preservice teachers reported the following difficulties while working in the geometry environment:

- Getting used to the wiki environment structure.
- Remembering to log in to the wiki environment before participating in the discussion, in editing already existing pages or in writing of new pages.
- Learning a new language – the wiki language.
- Choosing an aspect (history, art, and trip) to emphasize in the geometry lesson.
- Choosing a phenomenon or a field whose aspect the preservice teacher wanted to emphasize (for example, if the art aspect was chosen, then the preservice teacher had difficulty to decide on phenomenon or field whose art he wants to talk about (drawings, pictures, carvings, etc.).
- Choosing a geometry topic that fits the chosen phenomenon or field.
- Writing learning materials that fit the phenomena or field representing an aspect and at the same time the geometry topic
- Writing questions of different levels

SOLUTIONS AND RECOMMENDATIONS

The solutions, suggestions, recommendations, and reflection presented here do not just focus on difficulties confronted during this case, but also difficulties that could occur in similar cases, as well as what can be defined as proper educational wiki working methods.

Working in a Wiki Environment

The work in the wiki environment was enjoyed by the preservice teachers. It took preservice teachers' time and effort to suggest improvement for the already written geometry lessons, to perform the suggested improvements, and to write new lessons; however, they enjoyed the work in the wiki and committed much time in carrying out the wiki assignment. The wiki discussion section was not used by the preservice teachers only for discussing issues related to geometry lessons, but also for discussions of issues related to psychology and philosophy (e.g., one of the preservice teachers talked about the soul of the geometry text and so a discussion ensued about the text soul and the human soul). The preservice teachers also considered the wiki environment as another home where they could say hello, good morning, good night, etc. to each other. The wiki was a rich environment for the preservice teachers educationally, culturally, and socially. Though the wiki was a rich environment, it had its difficulties too. The following means and working methods were used to overcome most of the difficulties in an educational setting that is wiki-based. These means and working methods could be related to different aspects of working educationally in the wiki environment.

Combining Different Electronic Media to Overcome Possible Difficulties in Educational Communication

An electronic forum was opened for the preservice teachers, so that they were able to report links to the wiki pages that contained suggested improvements. The intensive use of this electronic forum by the preservice teachers resulted in three issues. First, it is important to connect between the wiki sites, which are 'outside sites' for the preservice teachers and the course site which is an 'inside site', which is a site that no one can enter, but them. This connection helped the preservice teachers consider the wiki sites as their own because

it was related to a site of their own – the course site. Second, it is difficult to follow multiple and simultaneous discussions, where the multiplicity resulted from discussions occurring at many wiki sites. Lastly, it is difficult to know who wrote what in the wiki sites when the writer forgot to register before writing and did not identify himself at the beginning or the end of his text. To overcome the described difficulties, a familiar environment was utilized (i.e., the electronic forum). We see here two working strategies, which could be utilized when trying to overcome difficulties of working in electronic environment like the wiki: (1) merging between two electronic environments and (2) utilizing familiar environments or work methods, which the students master.

Discussions in the Wiki Environment

The wiki environment enabled student-only discussions, as well as student-instructor discussions. When participating in a discussion, the instructor minimally communicated to let the preservice teachers settle their discussions by themselves. It is suggested that instructors give students the opportunity to initiate and develop their own discussions without unneeded interference; however, it should be made clear that the instructor should observe the work of students and intercede where needed. The absence of the instructor in the wiki environment can lead to the inefficiency of the work of students (Coutinho & Bottentuit Junior, 2007).

The structure of the wiki discussion section, which shows all of the discussions, enabled the preservice teachers to put their discussion in place of their choosing. This enabled the preservice teachers to follow the discussion themes easily and thus encouraged them to intensify their participation. The wiki environment could be utilized for fruitful discussions also when discussions were not the first stage of knowledge building but the main stage of such building.

The Wiki as an Environment for Developing the Preservice Teachers' Different Types of Knowledge

By suggesting improvements for the geometry lessons and wiki sites, performing the suggestions, and writing new geometry lessons, the preservice teachers developed content, pedagogic content, and pedagogic knowledge. The wiki environment has sections, which allow for discussion of existing texts, editing, and writing of new ones. To do so, the preservice teachers critically evaluated geometry texts and wrote new ones taking into consideration learning from the first two stages. It can be claimed that the wiki is a rich environment for the preparation of preservice teachers as future teachers. The preservice teachers in this case were empowered as learners and at the same time as teachers. This support for developing different types of knowledge enabled by the wiki environment agrees with Solvie (2008) who found that the wiki encourages the preservice teachers' construction of knowledge in reading methods courses. The case reported, along with the findings of Solvie, implies that the wiki can serve preservice teachers of sciences as well as of language and arts. The wiki can be suggested as a basic tool in preparing preservice teachers.

In addition to the previous three types of knowledge, the preservice teachers developed their knowledge in web design and site construction. At the beginning, they discussed the already constructed wiki sites and edited them according to agreed upon context of presenting the geometry lessons in the wiki sites. Afterwards they constructed their own sites taking into consideration what they learned about site design in the discussion and editing stages. The wiki did not only give the preservice teachers an opportunity to develop their knowledge as learners and teachers of geometry, but as designers and builders of web sites.

The preservice teachers' experiences in this case indicate that the wiki environment could be used to prepare the preservice teachers for

various teaching functions. What emphasizes this suggestion is the appreciation that the preservice teachers felt for working with an electronic tool, which could be used for teaching, and especially for building geometry and mathematics lessons. This appreciation focuses on two points: (1) the need of the preservice teachers for tools that assist in preparing learning materials, and (2) that the preservice teachers are aware of the various functions of the wiki as a tool for teaching and learning, and find these functions helpful for them as learners and teachers. This explanation of the preservice teachers' appreciation is supported by Jones (1999) who, detailing the functions of tools, emphasizes that "Tools are instruments of access to the knowledge, activities and practices of a community". Here, the community is the community of learners in the wiki environment.

This chapter suggests the wiki environment not only for preparing the preservice teachers for future teaching, but also for providing learners with a rich educational environment. The preservice teachers reported the fun with which they learned in the wiki environment. This fun could be attributed to the dynamic and collaborative nature of the wiki environment. The later two components encourage learning and make it enjoyable (Nada, Kholief, Tawfik & Metwally, 2008; Ragasa, 2009).

Solutions to Difficulties confronted by the Preservice Teachers

The preservice teachers confronted four types of difficulties throughout their whole work in the geometry wiki environment: (1) learning a new web language, (2) choosing an educational aspect, a phenomenon related to the educational aspect, or a geometry topic, (3) writing learning material which best fits the previously chosen educational aspect, the phenomenon and the geometry topic, and (4) writing geometry learning materials with different levels of difficulty.

To overcome the mentioned difficulties, the preservice teachers used the following means:

discussion of difficulty with partners and the instructor, references to previously written lessons and wiki sites, and consultation of study books and theoretical sources about teaching. The main method which the preservice teachers used to overcome the difficulties they confronted was the first method (i.e., discourse with the instructor and peers). Cobb, Boufi, McClain, and Whitenack (1997) found that discourse increased conceptual development. Latham (1997) found that discourse increased knowledge of a domain area, while Menke and Pressley (1994) found that discourse resulted in the improvement of task-related knowledge.

This case suggests that learners utilizing the wiki should be encouraged to discourse with their instructor, but especially with each other to overcome their difficulties when working in the wiki environment.

Utilizing the Various Functions of the Wiki Environment

The wiki discussion section was not used by the preservice teachers only for discussing issues related to geometry lessons, but often in the discussions stretching into issues related to psychology and philosophy. This demonstrates that the wiki can be a rich educational and cultural environment for students.

The wiki environment enabled student-only discussions, as well as student-instructor discussions, meaning that students can have control over their own learning in the wiki environment. The wiki environment did not only give the preservice teachers an opportunity to develop their knowledge as learners and teachers of geometry, but as designers and builders of web sites. It is suggested to use design contexts like the wiki in the preparation of preservice teachers, because developing the preservice teachers' classical types of knowledge in such context results, as well, in developing their knowledge of web design which

they may need to accomplish their different roles as teachers.

The preservice teachers emphasized the importance of being introduced to already written geometry lessons and discussing these lessons. These two actions were the basis, which helped the preservice teachers to write new geometry lessons. The model that this chapter suggests for using the wiki for educational purposes is to introduce the students to the wiki environment, require the students to evaluate, criticize and suggest improvements to the existing wiki educational texts, require the students to discuss their suggestions and agree on specific improvements, ask the students to perform the improvements they suggested, and ask the students to write their own wiki texts.

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KEY TERMS AND DEFINITIONS

Wiki: The wiki is a website that allows easy creation and editing of any number of interlinked

web pages, using a simplified markup language called the wiki language.

Wiki language: The wiki language has syntax which is similar to the html syntax but is less formal, for example it is enough to write `` without writing `` at the end to prosecute the syntax.

Wiki environment: The wiki website with all of its components: the article, the discussion section, the editing section and the history section.

Preservice teachers: Students learning to become teachers of a school subject like mathematics.

Geometry lessons: Lessons that are written for geometry students, so they are more similar to lessons that we find in a geometry book than to lesson plans, but, at the same time, wiki lessons are different from lessons in a book because of the dynamic nature of the wiki.

Discourse: It is the exchange of ideas, stands, opinions, etc.

Course instructor: The teacher or lecturer of the course.