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## FACTORS HINDERING TEACHERS FROM INTEGRATING NATURAL SCIENCES AND MATHEMATICS INTO HOME ECONOMICS COURSES

**Abstract.** *The purpose of this study was to examine the integration of natural sciences and mathematics into home economics teaching, particularly any factors hindering integration. Altogether 88 Slovenian home economics teachers were questioned. The results show that biology, consumer and health education were integrated into home economics courses more often than other subjects. Slovenian home economics teachers' integration of other school subjects or topics depends mainly on their work experience and combination of subjects during their undergraduate studies. Another indicator, a negative one, was that our teachers didn't know some relevant science and mathematics subject curricula and they are not enough competent in these sciences. This should be the first step in the future development of home economics teacher education.*

**Key words:** *education, home economics, integration, mathematics, natural sciences, teacher.*

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### Introduction

#### *The Case for Integration*

"Given a pile of jigsaw puzzle pieces and told to put them together, no doubt we would ask to see the picture they make. It is the picture, after all, that gives meaning to the puzzle and assures us that the pieces fit together, that none are missing and that there are no extras. Without the picture, we probably wouldn't want to bother with the puzzle... To students, the typical curriculum presents an endless array of acts and skills that are unconnected, fragmented, and disjointed. That they might be connected or lead toward some whole picture is a matter that must be taken on faith by young people" (Bean, 1991, p. 9).

Traditional subject disciplines are often like pieces of a puzzle without the picture. The boundaries of disciplines are limiting student access to broader meanings and understanding. The purpose of integration is to form a solid knowledge base which reaches beyond the boundaries of a particular subject (Lederman & Niess, 1997). Integration is defined as linking the teaching contents with other related fields of knowledge. It means an attractive approach of looking for connections with other subjects and making meaningful links. An integrated curriculum provides opportunities for less fragmented and more relevant experiences for learners (Jacobs, 1989), but the quality of integration is highly dependent upon what teachers do in the classrooms.

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*The Need for Integration in Home Economics Education*

Home Economics is a subject defined by as a 'field of study and a profession, situated in the human sciences that draws from a range of disciplines to achieve optimal and sustainable living for individuals, families and communities' (International Federation for Home Economics, 2008, p. 1). Home economics teaching offers numerous possibilities for integrating social sciences and natural sciences to explain various phenomena, observations and events (Darling, 1995; Davis, 1993; Richards, 2000; Yoo, 1999; Pendergast, 2006; McGregor, 2011).

Pendergast (2006) suggests that the subject is at a convergent moment, because a number of interconnected societal factors such as sustainability, global consumption, health and social justice are aligning around the profession. There is therefore growing alignment with the intentions of Home Economics to play a pivotal role in the development of informed global citizenry.

According to McGregor (2011), the intrinsic value of home economics as a discipline is that it integrates its sub-disciplines with a shared philosophical core - understanding of home economics as a holistic, professional system. McGregor (2011) wrote that home economists should draw on the cumulative knowledge base of contributing root disciplines (these disciplines have traditionally included the natural sciences, physical sciences, social sciences, the arts and humanities, etc.) in order to better meet the diverse needs of families and individuals. Therefore, teachers of home economics are challenged to use the information generated from these root disciplines and make it useful for families and individuals to solve practical problems (McGregor, 2008).

The purpose of the present study was to analyse to what extent other school subjects (disciplines) are integrated into home economics courses and particularly, to analyse different factors hindering the integration of science and mathematics subjects. The importance of cross-curricular teaching is frequently discussed in everyday pedagogical practice. The integration of the topics from sciences or mathematics into home economic courses was previously discussed by Rauma and Väisänen (2003) and Rauma et al. (2006) which helped us a lot in the study preparation phase.

Darling (1995) believes that methods which are typically used in science, e.g. inquiry based education, could be well utilised in home economics courses. For example, food preparation, which is one of the topics of home economics courses, includes various elements used in experiments: e.g. measuring, weighing, mixing, heating, cooling, etc. To understand the reactions or natural phenomena which occur during these operations, students need some root knowledge in the laws of science. Rauma et al. (2006) believe that home economics teachers should feel competent in understanding the basic laws of science (physics, chemistry, biology) as well as mathematics to be able to integrate these subjects into home economics courses. They (Rauma & Väisänen, 2003; Rauma et al. 2006) found out that Finnish teachers frequently combine mathematics and home economics, while combinations with biology, microbiology, chemistry and physics are less frequent.

*Elementary School System in Slovenia*

Before 1991, the Slovene educational system was a part of the uniform educational system of former Yugoslavia. It consisted of pre-school level education, organised by day-care centres and kindergartens, elementary school with lower and upper level, secondary education with target programmes, general secondary programmes (grammar schools), colleges, and undergraduate and post-graduate university programmes. In 1991, Slovenia introduced a transition model. The Education Act was passed in February 1996 introducing nine-grade compulsory education, followed by secondary grammar, vocational or professional schools with the system of state exams for continuing studies at the university. The educational system is vertically structured as follows:

- Pre-school education (children until age 6);
- Primary (elementary) education (children and youth from age 6-14);
- Secondary education (youth from 15-19 years);
- Tertiary education: universities and higher educational schools (young adults from age 19-



23) with PhD studies.

In the academic year 2003/2004 a new nine-grade primary school system was officially introduced. The system is divided into triads according to three age groups: from 6-9, 9-12 and 12-15. Teacher education is organised by the Faculty of Education in University of Ljubljana.

The home economics syllabus in the nine-grade primary school covers various areas, such as economics, nutrition, hygiene, textiles and clothing, footwear, interior design, health and consumer education. It is taught as an independent subject in the 5<sup>th</sup> and 6<sup>th</sup> grades of elementary school, and as an elective subject in the 7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup> grades (only nutrition). In addition to this, students are also engaged in practical activities within the Technology and Science Days programme which also relate to home economics topics. In the 5<sup>th</sup> and 6<sup>th</sup> grade of the nine-year elementary school curricula in Slovenia, it is compulsory for home economics teachers to design courses with a cross-curricular approach (Lap-Drozg et al., 2003).

In the eighth and ninth grade of elementary school students acquire specific knowledge of biology, chemistry and physics through individual courses, while basic science knowledge is acquired through courses on the environment in the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> grades, science and technology in the 4<sup>th</sup> and 5<sup>th</sup> grade, and natural sciences in the 6<sup>th</sup> and 7<sup>th</sup> grade. Mathematics is a compulsory subject from 1<sup>st</sup> to the 9<sup>th</sup> grade of elementary school.

## Methodology of Research

### *Sample*

The sample of this study was comprised of home economics teachers working in Slovenian primary schools. The questionnaires were handed in personally or sent by mail to 110 teachers. Within the deadline we received 88 completed questionnaires (80%). The structure of respondents by gender was: 81 (92%) female and 7 (8%) male teachers. The average age of the respondents was 41 years (SD=7.65; min=26; max=61). Most of the teachers were qualified professionals teaching a combination of two subjects: home economics and biology (49 teachers), home economics, biology and natural science (3 teachers), home economics and chemistry (13 teachers) or home economics and technology (6 teachers). In addition, there were seven teachers of biology and chemistry who also teach home economics courses and three professionals in food technology who had acquired additional pedagogical qualifications for teaching. Two respondents were also teachers of history and geography. We did not receive answers to this question from seven respondents. The average work experience of the respondents was 16 years (SD=8.99; min=1; max=36).

### *Instrument*

A self-administered questionnaire was adapted from Rauma et al. (2006); translated from English into Slovene language and several changes were made by researchers. The questionnaire was pre-tested with four respondents to identify the likely problems and to eliminate them. Five-level Likert scale (Likert, 1932) and open-ended questions were used in order to get information on the frequency of integrating other subject topics (11 items) and methods of integration (6 items); to explore with which subject teachers they are invited to cooperate and in which forms (open-ended question); and to get information on factors which hinder integration of science-mathematics topics into home economics teaching (7 items and 2 open-ended questions). Other questions referred to the age of respondents, gender, university degree, subject of the degree, and years of work experience as a Home Economics Teacher.

### *Statistical Analyses*

The data from the questionnaire were processed at the level of descriptive and inferential statistics. We used frequency variable distribution, basic descriptive statistics of variables, and the MANCOVA

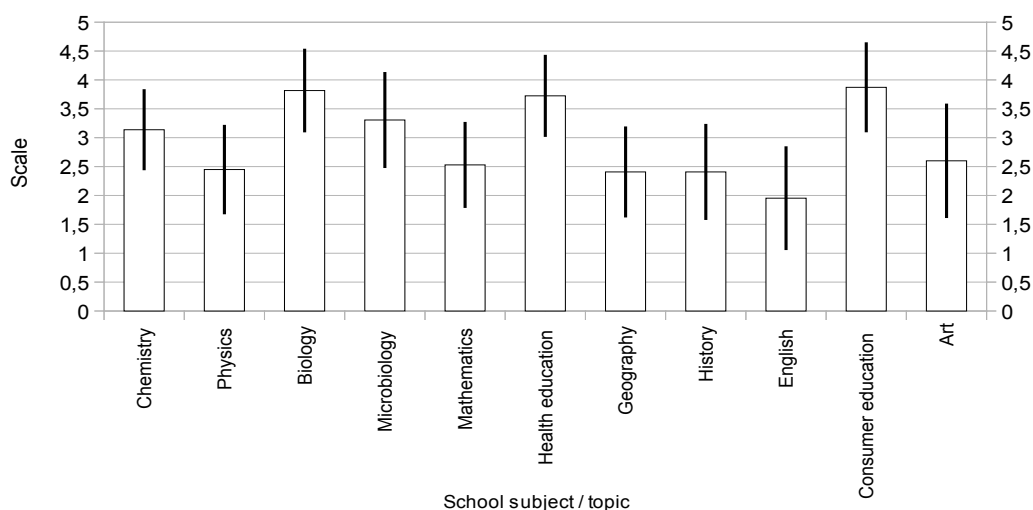


test and correlation analysis. The level of significance was set at  $p < 0.05$ . Some results are presented in the form of graphs. Internal reliability of the integration level scale was measured by using Cronbach's alpha.

## Results of Research

### *Integration of Different School Subjects and Topics into Home Economics Courses*

Teachers were asked how frequently they integrate various disciplines into home economics courses. An analysis of the results is given in Figure 1. The results show that biology, consumer education and health education are those school subjects or topics which are most frequently integrated into home economics teaching in Slovenia. Chemistry and microbiology are occasionally integrated, while mathematics, physics and other named subjects (topics) are only rarely integrated.



**Figure 1: Mean score and standard deviation for integration of other school subjects/topics into Home Economics courses (1-never, 2-seldom, 3-sometimes, 4-frequently, 5-always).**

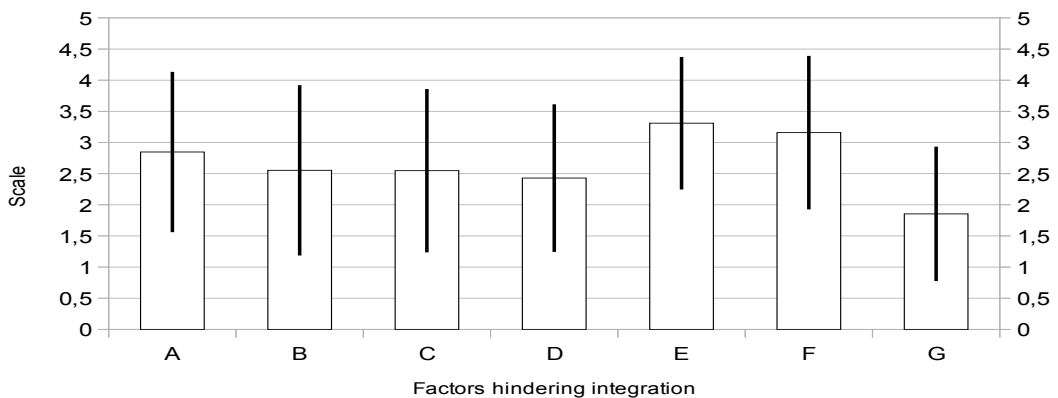
Further on, teachers were asked how often they use different methods for integration of other school subjects into home economics courses. The respondents had to select one of the options on a five-level scale (1-never, 2-seldom, 3-sometimes, 4-frequently, 5-regularly). It was found out that integration is most frequent when a teacher explains the reasons for a certain phenomenon (Mean=3.75, SD=0.75849). Other given options were also frequently mentioned: when the teacher needs to explain the interconnection between cause and effect (Mean=3.6667, SD=0.78131), in conducting practical work (Mean=3.6588, SD=0.86675), during class demonstrations (Mean=3.6506, SD=0.90303), when students carry out an experiment related to a natural phenomenon (Mean=3.5765, SD=0.85044), or when a particular mathematical skill is needed to carry out a task (Mean=3.5244, SD=0.99661).

Next, open-ended questions were used to explore with which subject teachers are invited to cooperate and what forms of integration are used. The most frequent forms of cross-curricular teaching are found among teachers of home economics and chemistry, biology and natural sciences. Mutual cooperation is most frequently made in organising Science and Technology Days where teaching goals are met as a cross-curricular effort. These are usually one day school events and excursions when different teachers jointly organise courses for students. Teachers also pointed out the importance of the formation of complex knowledge while integrating different schools subjects in everyday life skills.



*Factors Hindering the Integration of Science and Mathematics Subjects into Home Economics Courses*

The purpose of this study was primarily to discover the main factors hindering the integration of different school subjects into home economics courses, particularly to identify the problems which hinder the integration of science and mathematics subjects into home economics courses. Teachers were asked to answer seven statements and two open-ended questions. The results are shown in Figure 2. Among the most influencing factors limiting the use of integration as a teaching method were lack of textbooks and teachers' manuals that would offer enough ideas for integration and lack of time for integration in lessons. Another important factor which hinders better integration seems to be a lack of their competence in Physics, Chemistry, Biology and/or Mathematics as sciences. In addition to the given statements teachers added three other reasons which hinder integration: student age (too young), limited hours of home economics courses and lack of competence among teachers who are not professionally qualified for Home Economics teachers (e.g. chemistry, geography teachers) but they teach home economics subjects in the primary schools in Slovenia.



*Factors hindering integration: (A) Lack of competence in Physics, Chemistry, Biology and/or Mathematics as sciences. (B) It would be better to integrate other subjects into HE courses. (C) Not having sufficient knowledge of subjects such as Science and Math, and of the connections among the subjects. (D) Students are not interested in scientific explanations of phenomena. (E) Textbooks and teacher's manuals lack material supporting integration. (F) Lack of time in lessons. (G) Integration of mathematics or sciences into home economics teaching is less relevant.*

**Figure 2: Mean score and standard deviation for factors hindering the integration of science and mathematics subjects into home economics courses (1-strongly disagree, 2-disagree, 3-neither agree nor disagree, 4-agree, 5-strongly agree).**

An important factor with a positive influence on integration is if teachers knew the syllabi of science and mathematics subjects which are taught during the second and third triad in elementary schools. Most teachers were well-acquainted with the syllabi of biology (90.4%) and natural sciences (88.4%) while only two-thirds of teachers were acquainted with chemistry syllabus (67.5%). For other subjects the figures show much lower scores: science and technology (38.0%), mathematics (11.1%) and physics (32.5%). This findings support the results from the previous question where several home economics teachers reported lack of competence in science and mathematics subjects.

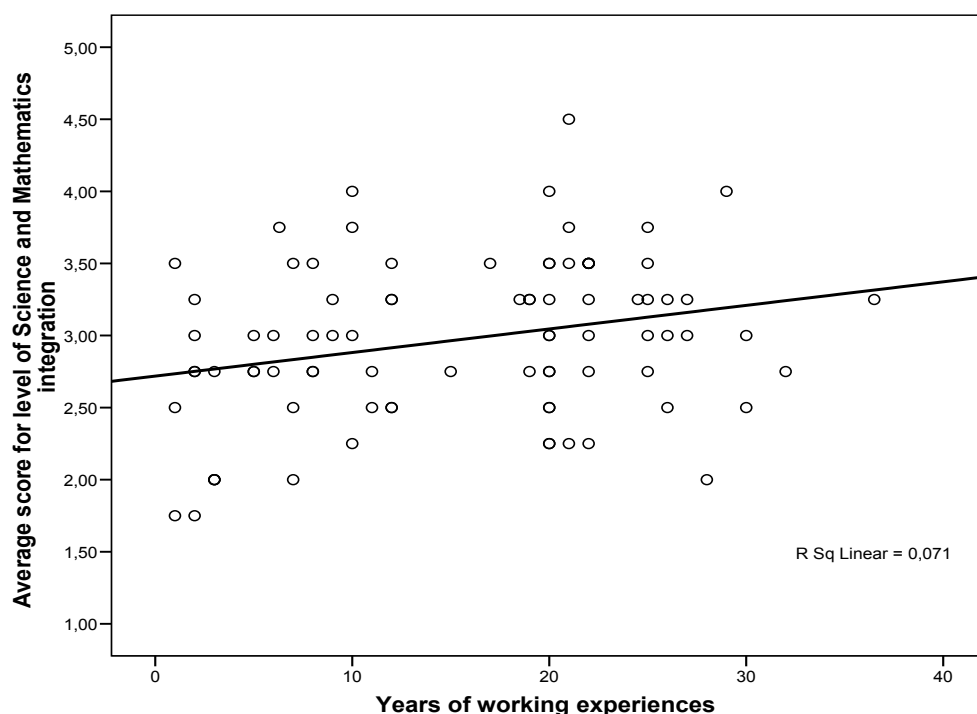
Another factor which could influence the frequency of integration is that most Slovenian teachers of home economics decided on combination of home economics and biology during their undergraduate studies. This is also confirmed in this study. For the last two decades the Faculty of Education at University of Ljubljana was the only faculty offering studies in home economics in Slovenia, and the only subject combination that could be taken was home economics with biology. Previously, students



could also combine home economics with chemistry or technology. However, with the Bologna reform, from the academic year 2009/10 on, the faculty extended combination options, thus making it possible to combine studies with chemistry and technology as well. The faculty is also considering a combination with general natural science studies that would give home economics teachers a better scientific background than traditional specialized academic studies (e.g. chemistry, biology).

A multivariate analysis of covariance (MANCOVA) with the frequency of integration of individual science subjects (chemistry, biology, physics) and mathematics, as a dependent variable, teacher's work experience as a co variable and the second study subject as independent variable was carried out. The analysis showed that the second study subject was an important factor of integration of chemistry topics into home economics teaching ( $F(4.84) = 5.739, p = 0.001$ ) and that work experience was a significant factor in introducing physics topics into home economics teaching ( $F = 5.363, p = 0.023$ ) or biology topics ( $F = 8.587, p = 0.004$ ). Other factors were statistically insignificant. The Turkey post-hoc test showed that those teachers who studied home economics in combination with chemistry, more frequently introduced chemistry topics into teaching compared with those teachers who studied home economics in combination with biology or technology. The results confirm that subject combination during undergraduate studies will later have impacts on the intensity of integration of other subject topics.

Last but not least, teachers with longer work experience were more frequently engaged in cross-curricular teaching and integrate topics from science and mathematics into home economics courses; compared with those less experienced ones (Figure 3). We found out that the average frequency of integration of main science subjects (chemistry, biology, and physics) and mathematics into home economics teaching was in positive correlation with teachers' work experience. It seems that with experience and intense cooperation with other subject teachers, home economics teachers developed competences for integration of other subjects into home economics courses. Reliability of the integration level scale was acceptable (Cronbach's alpha 0.74).



**Figure 3:** Correlation between average score for integration level and work experience of teachers ( $r = 0.267, p = 0.014, n = 85$ ).



## Discussion and Conclusions

Through this research we came to some conclusions which are highly relevant for home economics teachers' education in the future. The study showed that Slovenian home economics teachers were engaged in cross-curricular teaching; however the integration of other school subjects depends mainly on their work experience and combination of subjects during their undergraduate studies. This is in line with the results of Rauma et al. (2006). Another indicator, a negative one, was that our teachers didn't know some relevant science and mathematics subject curricula and they are not enough competent in these sciences. This should be the first step in the future development of home economics teacher education. According to International Federation for Home Economics (2008, p. 1) home economics draws from a range of disciplines to achieve optimal and sustainable living for individuals, families and communities; consequently, home economics teachers should give greater attention to the integration of root sciences, like natural, social and human sciences.

During undergraduate studies, students of home economics should acquire more applied knowledge in science and mathematics which they could later integrate into their teaching practice. Already during studies they should learn about the contents and teaching goals of other related subjects (e.g. natural sciences, science and technology, society, chemistry, biology, physics, geography) since only this would allow for better integration of other topics into their courses.

According to our research it is easier for more experienced teachers to introduce science and mathematics topics into their teaching practice and there are opportunities for more intense cooperation when teachers prepare students for events such as Science and Technology Days. With years of experience the intensity of cooperation grows. Therefore, in the future, there should be more opportunities for teachers to engage in such joint activities knowing that team-work has positive effects on subject integration. Also experienced teachers should be motivated to help younger colleagues in integrating school subjects into home economics courses.

Another possibility is to introduce inquiry-based education as a method of teaching, where students work under the joint mentorship of two or more different subject teachers. Such possibilities are, for example, if students are making products made of felt (caps, slippers, door mats, jewellery...) where other subject teachers can contribute their own subject-specific aspects: e.g. a chemistry and physics teacher could explain the chemical and physical side of manufacturing felt and properties of natural fibres, a biology teacher could contribute the explanation on the biology aspects of fibres (sheep yarn), the art teacher could give ideas on how to use felt for creative products, etc.

Finally, to mitigate the problem of inadequate textbooks and teacher's manuals which obviously do not give enough ideas for cross-curricular teaching, professionals and practitioners dealing with home economics should provide more examples of good practice and publish them in the professional literature or include them in teacher's books. A modern and useful form of informing teachers is organising web portals and forums, or annual professional meetings for teachers where practical examples of integrating subjects could be presented.

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