



Gender Differences of Ukrainian Eighth Graders in Matters Related to Education Obtained From TIMSS-2011 Results

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Data

- International large scale assessments
 - TIMSS 2011
 - Math and Science
 - 63 countries and 14 benchmarking entities
 - Ukraine: 3378 eighth graders



General results: gender aspect

- **International:** boys had higher achievement than girls in number but girls had higher achievement in algebra, geometry, and data and chance
- **Ukraine:** boys outperformed girls in number, the differences in other content domains is not significant



(General results: gender aspect)

- **International:** girls outperformed boys on average in both the knowing and reasoning cognitive domains.
- **Ukraine:** boys significantly outperformed girls in applying.
- Gender differences in science achievement at the eighth grade were larger, on average, than at the fourth grade, with the difference favoring girls (international average: 480 vs. 474)



(General results: gender aspect)

- **International:** girls outperformed boys in Biology and Chemistry, but boys had higher achievement in Earth Science.
- **Ukraine:** boys outperformed girls in Earth Science as well, but also in Physics. There is no significant difference in Biology and Chemistry



(General results: gender aspect)

Across participant countries girls performed better than boys in all cognitive domains, whereas no significant differences were found for Ukraine



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Goal

To analyze answers of Ukrainian TIMSS participants to a **Student Questionnaire** in order to find the differences between boys and girls in matters related to Math and Science education.



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Methods

- **Mashine Learning:** looking for patterns in data
- Rules an Decision Trees as a classification models
- What answers to questionnaire questions defines respondent as boy or girl?
- Tools: Weka software



Results: One Rule algorithm

- WEKA output

How often you talk about schoolworks with parents?:

NEVER OR ALMOST NEVER	-> BOY
EVERYDAY OR ALMOST EVERYDAY	-> GIRL
ONCE OR TWICE A WEEK	-> BOY
ONCE OR TWICE A MONTH	-> BOY
OMITTED OR INVALID	-> BOY

(2013/3375 instances correct)

Correctly classified instances	2013	59.6444 %
Incorrectly classified instances	1362	40.3556 %



Results: One Rule algorithm

So if a person claimed that she/ he **talk about school works with parents everyday or almost everyday**, then it was likely that it was a **girl**. **All other answers**, including missed ones, point to a **boy**.



Results: Decision Tree (J4.8)

How often you talk about schoolworks with parents? = NEVER OR ALMOST NEVER: BOY (137.0/48.0)

How often you talk about schoolworks with parents? = EVERY DAY OR ALMOST EVERYDAY

| Would like job using physics = DISAGREE: GIRL (1283.0/447.0)

| Would like job using physics = AGREE: BOY (625.0/303.0)

| Would like job using physics = OMITTED OR INVALID: BOY (17.0/4.0)

| Would like job using physics = LOGICALLY NOT APPLICABLE: BOY (3.0/1.0)

How often you talk about schoolworks with parents? = ONCE OR TWICE A WEEK

| Would like job using physics = DISAGREE

| | Students like learning biology = LIKE LEARNING BIOLOGY: GIRL (302.0/142.0)

| Students like learning biology = SOMEWHAT LIKE LEARNING BIOLOGY: BOY (300.0/144.0)

| | Students like learning biology = DO NOT LIKE LEARNIN GBIOLOGY: BOY (88.0/25.0)

| | Students like learning biology = LOGICALLY NOT APPLICABLE: BOY (3.0/1.0)

| | StudentsLikeLearningBiology = OMITTED OR INVALID: BOY (2.0)

| WouldLikeJobUsingPhysics = AGREE: BOY (326.0/86.0)

| WouldLikeJobUsingPhysics = OMITTED OR INVALID: BOY (16.0/5.0)

| WouldLikeJobUsingPhysics = LOGICALLY NOT APPLICABLE: BOY (2.0)

How often you talk about schoolworks with parents? = ONCE OR TWICE A MONTH: BOY (234.0/100.0)

How often you talk about schoolworks with parents? = OMITTED OR INVALID: BOY (37.0/9.0)



Subtopics

1. Students' attitude toward learning and school subjects
2. Relationships with parents
3. Things happened to students at school.



Results by subtopics

1. (Students' attitude toward learning and school subjects)

- boys would like a job that involves using physics;
- boys value learning mathematics;
- girls like learning biology and would like a job that involves using biology;
- girls do not value learning physics and somewhat value learning mathematics.

The most decisive statement:

“would like a job that involves using physics”



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Results by subtopics

2. (Relationships with parents)

The most decisive statement:

“I often talk about school works with parents”



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Results by subtopics

3. (Things happened to students at school)

The most decisive statement:

“I was left out of games or activities by other students”



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Conclusions

- Machine learning models allows obtaining patterns from raw data easy to interpret.
- In our case, we got some patterns that allow seeing gender differences in Ukrainian 8th graders responses to the TIMSS Questionnaire.
- Most likely, they are explained by the traditions of upbringing of children of different genders and early orientation in “male” and “female” activities in family and school.



Thank you for attention!

Any questions?



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