
The Concept of Sustainable Development in the Curriculum of the Medical Universities in Poland

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Abstract:

Purpose: The purpose of the research was to obtain and process data pertaining to the elementary sustainable development (SD) knowledge medical university students in Poland possess in order to grasp their expectations relating to this field.

Design/Methodology/Approach: The research employed the diagnostic poll method. The study was conducted between March and September 2020 among 636 students of medical universities in Poland. The comparative analysis of qualitative variables employed Pearson's χ^2 test and contingency tables. The non-parametric Kruskal-Wallis ANOVA and the Mann-Whitney U test were applied in the analysis of rank order scale responses.

Findings: Findings of the research confirm the existence of an educational gap concerning education for sustainable development (ESD) at medical universities in Poland. The study confirmed that the students possess elementary knowledge of sustainable development. It ought to be noted that they associate SD primarily with environmental and economic aspects. The analysis of results also revealed that the students are aware of the impact an individual may exert upon sustainable development. The study indicated that men proved to be familiar with elementary SD terminology significantly more frequently than women.

Practical Implications: The results of the study offer a basis for changes in educational curricula and in projects executed at medical universities concerning SD-associated matters.

Originality/Value: Results concerning education, fundamental SD knowledge and familiarity with SD-related issues exhibited by medical university students in Poland. The results consider the impact of various variables such as gender, field of study, year of study, and grade point average.

Keywords: Sustainable development, medical education, sustainable development goals.

JEL codes: I21, I23, I25, Q56.

Paper Type: Research article.

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1. Introduction

The correlation of a nation's education system and the nation's economic development is a valid issue worldwide (Jellenz *et al.*, 2020). As a consequence, education for sustainable development (ESD) is considered as the critical instrument of societies' transformation towards sustainable development (Hajdukiewicz and Pera, 2020; Blewit and Cullingford, 2004). The literature of the subject refers to education as a critical factor determining the achievement of sustainable development goals (Hansmann and Binder, 2020; Wiek *et al.*, 2011). Education ought to encompass all education levels (Daigle and Vasseur, 2019; Kapitulcinova *et al.*, 2018), starting with pre-school and up to university studies.

Higher education institutions play a special role in the process. They are to educate, promote and foster the development of knowledge and skills required to arrive at sustainable development (Sandoval *et al.*, 2020). On the other hand, ESD programs ought to be designed based on the "triple bottom line, finding a balance between social/economic/environmental (SEE) aspects of sustainable development" (Stevenson, 2006). The review of literature revealed a research gap in education for sustainable development among the students of medical universities. The students and graduates of such universities are directly involved in the pursuit of SD objectives because, as a professional group, they operate within the health-care-related goal in the 2030 Agenda for Sustainable Development. As a consequence, establishing the way in which this particular group understands and applies SD principles seems especially vital.

The objective of the present study was to obtain and process data pertaining to the elementary SD knowledge medical university students in Poland possess in order to grasp their expectations relating to this field.

The literature points to the critical role of universities in ESD. They are to fill the gap which emerged at lower levels of education (Sharma and Kelly, 2014). One of the most vital factors exerting a positive impact upon environment-friendly attitudes is knowledge (Eilam and Trop, 2012), whose boost may improve the attitude of learners and raise their awareness as regards care for environment (Liao and Li, 2019). Previous research confirms in-depth SD knowledge among students (Al-Naqbi and Alshannag, 2018; Esa, 2010; Tuncer, 2008). In addition, previous studies discuss differences in the knowledge and perception of SD as regards gender (Kagawa, 2007; Tuncer, 2008; Vicente *et al.*, 2013) and faculties/ fields of study (Sandoval *et al.*, 2020). Other variables have not been extensively studied (Al-Naqbi and Alshannag, 2018).

The literature of the subject highlights the necessity of employing diversified educational methods for ESD. In addition, education which aims to meet specific objectives re-quires a variety of approaches across the curriculum instead of a focus upon individual classes/courses (Mula *et al.*, 2017). This is especially valid due to

the fact that universities ought to combine theoretical approach and model problem-solving with actual actions being taken (Cichowicz and Nowak, 2018). As a consequence, when designing curricula and the content of courses, not only “factual knowledge” but also “action-related knowledge” and “effectiveness knowledge” ought to be incorporated (Maurer and Bogner, 2019). Crucially, this approach should maintain a diversity of teaching methods. The following research questions were posed based on the results of the previous research:

1. In the opinion of medical university students, who is responsible for natural environment protection in Poland? And who is responsible for shaping people’s attitudes towards sustainable development (SD)?
2. How do the students of medical universities assess their previous ESD?
3. Whether and in what manner do medical universities raise their students’ awareness of environment-related issues?
4. Are medical university students in Poland familiar with the term “sustainable development” and Sustainable Development Goals?
5. Is the familiarity with SD issues determined by the socio-demographic profile of students (e.g. gender, field of study, year of study, grade point average)?
6. Which forms of SD education do the students of medical universities prefer?

2. Materials and Methods

The present study employed the diagnostic poll research method. The study was conducted between March and September 2020. The questionnaire was distributed by means of social media, such as Facebook, among community groups of medical university students in Poland. The selection of this communication channel was motivated by two factors: 1) the present COVID-19 pandemic in Poland and restrictions in the operation of universities in the country, and 2) the fact that Facebook is the most popular social media platform: 89% of Internet users aged 16-64 use Facebook (Digital 2020 Poland). The study applied non-probability sampling: snowball sampling technique was employed. The questionnaire was posted in Facebook’s public groups for students of medical universities, who then were able to share it further. In addition, the questionnaire was emailed to faculty members teaching classes at medical universities. They were requested to share it with the students of the particular university. Participation in the study was voluntary and anonymous.

The questionnaire consisted of 11 questions pertaining to issues such as responsibility for sustainable development, ESD assessment and expectations, the understanding of the term, SD aspects and objectives. The questionnaire featured multi-select questions. In addition, questions 2, 10 and 11 applied the 5-point Likert scale by means of which the respondents assessed the intensity of a particular phenomenon: 1-denoted a lack of correlation, and 5- strong correlation.

The comparative analysis of qualitative variables was conducted by means of the Pearson's χ^2 and contingency tables. For the comparison of answers provided by means of the rank order scale, the non-parametric Kruskal-Wallis ANOVA and Mann-Whitney U tests were applied as the non-parametric equivalent of the Student's t-test. The selection of the tests was motivated by the lack of normal distribution of answers measured by means of the ordinal scale. All statistical analyses in the study, as well as the visualizations of results, were developed in the R statistical software environment with the application of specialized packages: ggplot2, sjPlot, gtsummary, flextable, dplyr, rstatix and ggstatsplot.

The questionnaire was completed and returned by 636 respondents studying at medical universities in Poland. Based on the literature, the sample was characterized by means of the following variables: gender (female n=496, 79%; male n= 135, 21%, unknown 5) and field of study (physiotherapy n=8, 1,3%, medicine n=348, 55%, nursing/midwifery n=165, 26%, emergency medical service n=20, 3,2%, dentistry n=48, 7,6%, public health n=14, 22%, other n=31, 4,9%). The variables diversified the sample as regards the learning process (Table 1).

Table 1. Description of the sample.

Grade point avg.	n	%	Year of studies	n	%
to 3.5	13	2.2	1	87	14
3.6-4.0	135	23	2	146	23
4.1-4.5	319	55	3	151	24
4.6 or more	112	19	4	92	15
Unknown	57		5	83	12
			6	67	11
			Unknown	10	

Source: Own study.

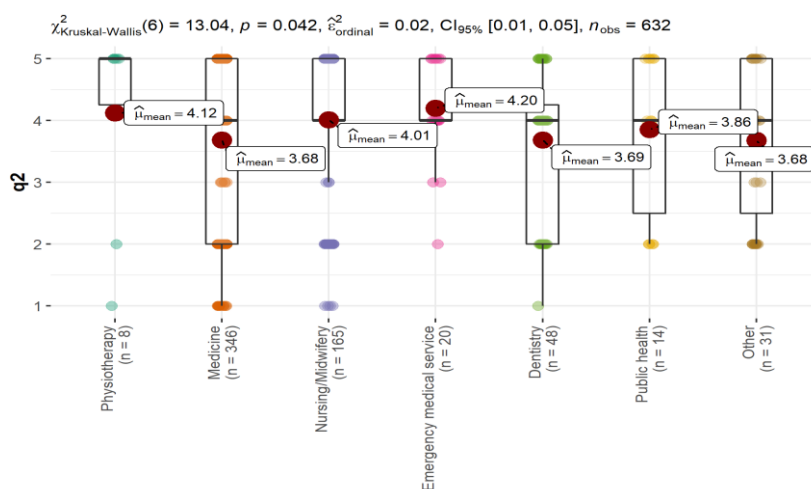
3. Results

3.1 Responsibility for Sustainable Development

According to the respondents' answers, everyone bears responsibility for sustainable development. They believe that the largest responsibility ought to be borne by individuals/people (81%), non-government organizations, both local (60%) and national (77%), and enterprises (51%). Such results enabled the establishment of the answer to research question 1 (responsibility for sustainable development in Poland). The results are convergent with respondents' answers concerning the impact of individuals upon SD. The respondents assessed the impact in the following manner: very low (2.8%), low (22%), no opinion (2.2%), high (38%), and very high (35%). The average score in the sample was 3.79 (1.2) and exceeded the neutral threshold. Both characteristics indicate that the students are aware of the impact of individuals and their behavior upon sustainable development.

Statistically significant differences were noted in the perception of an individual's impact upon SD (Q2) in relation to the field of study (Figure 1). A box plot was developed for each of the fields of study. The box plot enables to assess the distribution of variable Q2 in relation to the individual fields of study. Each of the box plots features a line denoting the median. Lower and upper sides of the box denote the lower and upper quartile respectively (i.e., 0.25 and 0.75 order percentile values). The whiskers denote the 1.5x interquartile range (IQR, the lower quartile subtracted from the upper quartile).

Figure 1. Distribution of responses to the question concerning the impact of an individual upon SD in relation to the year of study.



Source: Own study.

The analysis of results revealed that the students of emergency medical services indicated the strongest correlation between the actions of an individual and the impact upon the surrounding environment. On the other hand, the students of medicine, dentistry and fields of study labeled as “other” believed the correlation was weak. The variability in the individual groups ought to be emphasized. The group of students representing Physiotherapy, Nursing and Emergency medical services courses has low variability (short box), whereas the one representing Medicine manifests high variability. In relation to the remaining variables (gender, year of study, university, grade point average), no statistically significant differences were noted in the responses to the question.

When analyzing responses to the question concerning the institution responsible for shaping SD attitudes, it was noted that respondents primarily indicated the following: educational institutions (93%), media (77%), immediate surroundings, e.g. friends, family (75%), and government (75%). It is noteworthy that merely

37% of responses pertained to environmental organizations directly involved in environment protection.

3.2 Education for Sustainable Development

ESD ought to be introduced on all education levels (Daigle and Vasseur, 2019). As a consequence, students of medical universities were requested to evaluate their previous SD education (as a collective of all levels of education). As far as Q4 is concerned, respondents perceived their previous SD education in the following manner: answer 1- it improved my environment-related behavior (19%), answer 2- it raised my environmental awareness (35%), answer 3- it did not meet my expectations (34%), answer 4- it did not change my attitude to environment protection (7.9%), answer 5- it was useless (4.4%).

In light of the foregoing, the respondents can be divided into two fundamental groups, those whose SD awareness rose in the course of education, and those whose SD expectations were not met. It ought to be noted that merely 4.4% of respondents considered SD education as useless. The results of the analysis regarding the previous ESD were analyzed by means of the chi-square test. Statistically significant differences were noted for the previous ESD vs. the respondents' field of study. Students of Medicine, and Nursing and Dentistry offered a positive evaluation of the previous ESD with above-average frequency. On the other hand, the negative assessment of the previous ESD was offered with above-average frequency by the students of Public health and Physiotherapy.

In connection with the previous ESD experiences, the respondents were requested to express their attitude towards the need for further SD knowledge improvement. In this case, positive responses were predominant and their distribution was the following: rather agree (33.2%) and completely agree (20.9%). This acknowledges the students' awareness of the need for further SD knowledge improvement. In addition, 15% of respondents answered they were acquiring SD knowledge at the moment of the study. For the statistical analysis of responses to the question regarding sustainable development knowledge, the Mann-Whitney U test was applied: $\log_e(W_{\text{Mann-whitney}})=10.27$, $p= 0.003$, $\hat{r}=0.13$, $CI_{95\%}[0.05, 0.20]$, $n_{\text{obs}}=533$. Statistically significant differences emerged regarding gender vs. SD knowledge improvement. The test revealed that women expressed a stronger need for SD knowledge improvement ($\hat{u}=3.68$) than men ($\hat{u}=3.28$). The results may suggest that women have a stronger inclination towards knowledge improvement because, according to studies, they care for the environment more than men (Xiao and McCright, 2015). Therefore, they may feel a stronger interest in knowledge in the field.

The literature of the subject highlights the necessity of proceeding with ESD in a diversified manner by means of a variety of teaching methods and tools. In order to establish the answer to research question 6, the students of medical universities

were queried concerning their preferred forms of education. The students indicated a strong preference for education via direct contact with the subject matter e.g. problems concerning the natural environment (49.4%). Students are also likely to attend e-learning courses and trainings (36.5%), SD classes offered at the university (35.3%) and a variety of environment-related events (35.2%). Traditional learning methods, such as meetings and seminars (28.1%), and printed materials, e.g. publications (26.4%) were selected more seldom.

According to the respondents, the main initiatives to be introduced in order to boost the society's care for the natural environment encompass the improvement of knowledge and environmental awareness of societies (86%). Solutions pertaining to the consequences of particular actions were indicated less frequently. The consequences included penalties for non-compliance with regulations (71.5%), and awards for environment-friendly activities (58.5%). Such results acknowledge the students' awareness pertaining to the impact of education upon the pursuit of SD principles. The ESD gap also appears at medical universities in Poland. This fact was reflected in the results of this study. The majority of respondents (84%) stated they were not certain if their university offered SD-awareness-raising classes. As a consequence, the answer to research question 3 is negative.

3.3 Fundamental SD Knowledge and Familiarity with SD-Related Issues Exhibited by Medical University Students in Poland

Previous studies proved the existence of a correlation between knowledge and environment-friendly activities (Eilam and Trop, 2012). As a consequence, the students of medical universities were queried concerning the familiarity with the term "sustainable development". The majority of students declared they were familiar with the term (85%). However, less than half of respondents (43%) were able to specify the exact meaning. The analysis of results revealed statistically significant differences in relation to gender as regards the familiarity with the meaning of the term (p -value 0.036, chi-square test of independence). Women were unsure of the meaning of the term more frequently than men (female respondents 44.1% vs. male respondents 33.3%). On the other hand, men declared familiarity with the meaning of the term more frequently (male respondents 52.6% vs. female respondents 40.5%). The results of the analysis provided the answer to the question concerning gender-dependent differences as regards the familiarity with the term "sustainable development" (research question 5).

In order to obtain data pertaining to the familiarity with specific SD aspects, the respondents were requested to determine the intensity of the relationship (Likert scale) between the specific aspect and SD. When considering the mean values of results, it can be argued that medical university students indicated a strong correlation between SD and the following fields: social aspects 3.62 (1.12), economic aspects 4.22 (1.03), environmental aspects 4.30 (1.01), political and institutional aspects 3.74 (1.13). As a consequence, it seems that all the aspects are

associated with SD in one way or another. The students predominantly associate sustainable development with environmental and economic aspects.

The study analyzed the familiarity with fundamental SD guidelines outlined in the 17 SD goals featured in the 2030 Agenda for Sustainable Development (G1-G17). With respect to each goal, the respondents were requested to state the intensity of the correlation between each of the goals and SD (Likert scale). The results are presented in Table 2.

Table 2. Correlation between individual aspects and sustainable development.

Definitely no	No	I have no opinion	Rather yes	Definitely yes	Mean
Goal 1 (G1) End poverty in all its forms everywhere					
26 (4.1%)	56 (8.8%)	139 (22%)	242 (38%)	173 (27%)	3.75 (1.07)
Goal 2 (G2) End hunger, achieve food security and improved nutrition and promote sustainable agriculture.					
12 (1.9%)	22 (3.5%)	45 (7.1%)	262 (41%)	295 (46%)	4.27 (0.88)
Goal 3 (G3) Ensure healthy lives and promote well-being for all at all ages.					
15 (2.4%)	38 (6.0%)	79 (12%)	244 (38%)	260 (41%)	4.09 (0.99)
Goal 4 (G4) Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.					
12 (1.9%)	21 (3.3%)	43 (6.8%)	176 (28%)	384 (60%)	4.41 (0.90)
Goal 5 (G5) Achieve gender equality and empower all women and girls.					
35 (5.5%)	54 (8.5%)	127 (20%)	163 (26%)	257 (40%)	3.87 (1.19)
Goal 6 (G6) Ensure availability and sustainable management of water and sanitation for all.					
12 (1.9%)	10 (1.6%)	45 (7.1%)	163 (26%)	406 (64%)	4.48 (0.84)
Goal 7 (G7) Ensure access to affordable, reliable, sustainable and modern energy for all.					
9 (1.4%)	11 (1.7%)	39 (6.1%)	158 (25%)	419 (66%)	4.52 (0.80)
Goal 8 (G8) Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.					
11 (1.7%)	9 (1.4%)	60 (9.4%)	221 (35%)	335 (53%)	4.35 (0.84)
Goal 9 (G9) Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.					
9 (1.4%)	20 (3.1%)	55 (8.6%)	216 (34%)	336 (53%)	4.34 (0.87)
Goal 10 (G10) Reduce inequality within and among countries.					
28 (4.4%)	49 (7.7%)	116 (18%)	212 (33%)	231 (36%)	3.89 (1.11)
Goal 11 (G11) Make cities and human settlements inclusive, safe, resilient and sustainable.					
12 (1.9%)	50 (7.9%)	92 (14%)	248 (39%)	234 (37%)	4.01 (1.00)
Goal 12 (G12) Ensure sustainable consumption and production patterns.					
14 (2.2%)	15 (2.4%)	59 (9.3%)	218 (34%)	330 (52%)	4.31 (0.90)
Goal 13 (G13) Take urgent action to combat climate change and its impacts.					
14 (2.2%)	20 (3.1%)	45 (7.1%)	132 (21%)	425 (67%)	4.47 (0.92)
Goal 14 (G14) Conserve and sustainably use the oceans, seas and marine resources for sustainable development.					
13 (2.0%)	14 (2.2%)	33 (5.2%)	148 (23%)	428 (67%)	4.52 (0.86)
Goal 15 (G15) Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.					
11 (1.7%)	12 (1.9%)	35 (5.5%)	151 (24%)	427 (67%)	4.53 (0.83)
Goal 16 (G16) Promote peaceful and inclusive societies for sustainable development, provide access					

to justice for all and build effective, accountable and inclusive institutions at all levels.					
21 (3.3%)	42 (6.6%)	123 (19%)	195 (31%)	255 (40%)	3.98 (1.08)
Goal 17 (G17) Strengthen the means of implementation and revitalize the global partnership for sustainable development.					
13 (2.0%)	25 (3.9%)	84 (13%)	220 (35%)	294 (46%)	4.19 (0.95)

Source: *Own study.*

Medical university students indicated the strongest correlation between SD and the goals which are strictly connected with the natural environment. The goals include e.g. conservation of terrestrial ecosystems, forests and soil, marine resources, as well as combating climate change. According to the respondents, affordable and clean energy is also significant. Access to education is the social aspect the students linked with SD the most.

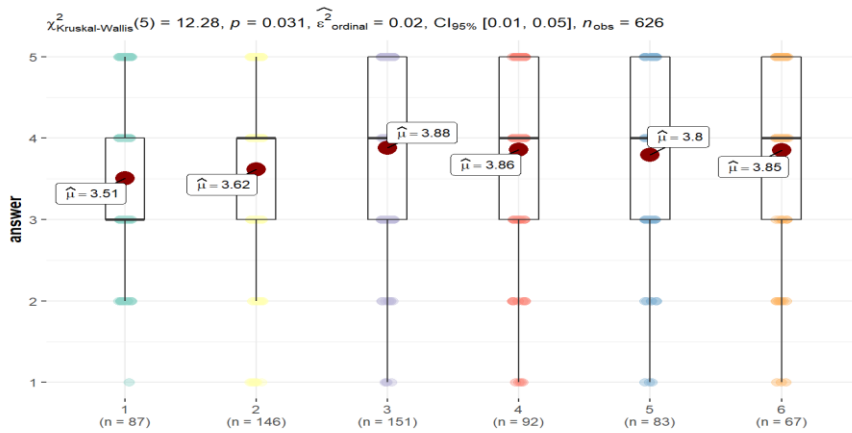
As regards the economic aspect, the sustainable economic growth and sustainable industrialization and support for innovation are of significance. It ought to be noted that the students of medical universities indicated the goal directly linked with health as “rather associated” with SD.

The results pertaining to SD goals were analyzed statistically in order to establish the answer to the question concerning the relationship between the goals and variables such as gender, year of study and grade point average. Statistically significant differences were noted for the correlation between G14 and G15, and respondents’ gender. The Mann-Whitney U test was applied in both cases:

- G14 $\log_e(W_{\text{Mann-whitney}})=10.51$, $p= 0.045$, $\hat{r}=0.08$, $CI_{95\%}[-0.01, 0.16]$, $n_{\text{obs}}=631$, female $\hat{u}=4.56$, male $\hat{u}=4.34$;
- G15 $\log_e(W_{\text{Mann-whitney}})=10.52$, $p= 0.029$, $\hat{r}=0.09$, $CI_{95\%}[0.02, 0.15]$, $n_{\text{obs}}=631$, female $\hat{u}=4.57$, male $\hat{u}=4.36$.

As regards the conservation of marine and terrestrial ecosystems, women assigned a higher rank to these objectives than men. However, it ought to be noted that for both G14 and G15, the average value of women’s and men’s responses was very high (above 4).

When analyzing the relationship between the social goals featured in the 2030 Agenda for SD and the variables, statistically significant differences were noted for gender and the year of study. The differences pertained to e.g. the correlation between G1 and the year of study (Figure 2). At the beginning of their medical studies, the students assigned a lower rank to this objective. However, as they continued their university education, the significance of the rank increased. This may denote that as students of medical universities progress in their education, they become increasingly aware of the problem of poverty and the necessity of combating it.

Figure 2. Significance of G1 vs. year of study.

Source: Own study.

Statistically significant differences concerning social goals were also revealed for the relationship between respondents' gender and G3, G5, G11, and G16. For all these goals, women assigned higher ranks to these objectives:

- G3 $\log_e(W_{\text{Mann-whitney}})=10.59, p=3.23e-04, \hat{r}=0.14, CI_{95\%}[0.05, 0.23], n_{\text{obs}}=631, \text{female } \hat{u}=4.19, \text{male } \hat{u}=3.76;$
- G5 $\log_e(W_{\text{Mann-whitney}})=10.72, p= 3.12e-11, \hat{r}=0.26, CI_{95\%}[0.20, 0.34], n_{\text{obs}}=631, \text{female } \hat{u}=4.05, \text{male } \hat{u}=3.17;$
- G11 $\log_e(W_{\text{Mann-whitney}})=10.54, p= 0.015, \hat{r}=0.10, CI_{95\%}[0.01, 0.17], n_{\text{obs}}=631, \text{female } \hat{u}=4.07, \text{male } \hat{u}=3.77;$
- G16 $\log_e(W_{\text{Mann-whitney}})=10.53, p= 0.026, \hat{r}=0.09, CI_{95\%}[0.00, 0.18], n_{\text{obs}}=631, \text{female } \hat{u}=4.04, \text{male } \hat{u}=3.73.$

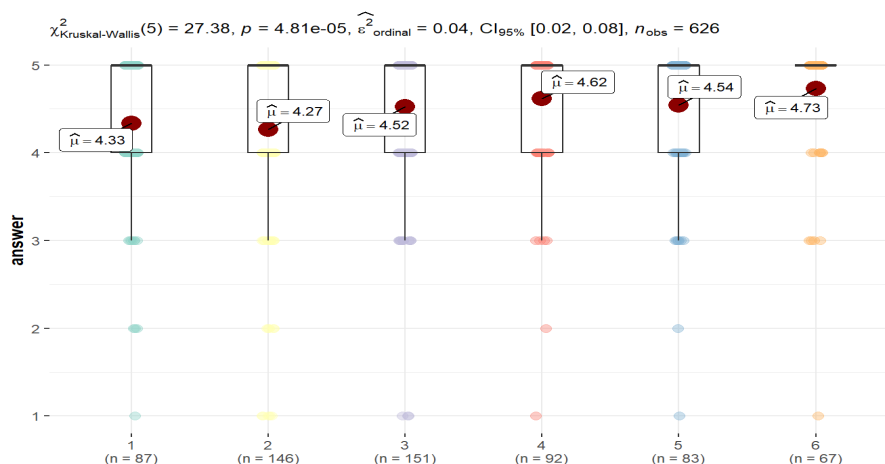
The goals in the 2030 Agenda for SD also pertain to objectives associated with sustainable economic development. Statistically significant differences were observed for G6 vs. year of study (Figure 3). The higher the year of study, the higher the rank for the goal. As a consequence, it can be argued that the awareness of sustainable management of water resources rose as students progressed in their studies.

Statistically significant differences regarding economic development were also noted for G8 and G12 vs. respondents' gender. Women assigned a higher rank to both G8 and G12. However, it ought to be noted that both genders assessed the significance of G8 and G12 as very high (above 4.0):

- G8 $\log_e(W_{\text{Mann-whitney}})=10.51, p= 0.048, \hat{r}=0.08, CI_{95\%}[-0.01, 0.15], n_{\text{obs}}=631, \text{female } \hat{u}=4.4, \text{male } \hat{u}=4.19;$

- G12 $\log_e(W_{\text{Mann-whitney}})=10.51$, $p= 0.054$, $\hat{r}=0.08$, $CI_{95\%}[0.00, 0.16]$, $n_{\text{obs}}=631$, female $\hat{u}=4.37$, male $\hat{u}=4.11$.

Figure 3. Significance of G6 vs. year of study.



Source: Own study.

To conclude the discussion concerning the statistical analysis of responses regarding SD goals, it can be argued that women assigned higher ranks to the individual goals than men. This offers the answer to research question 8. The differences revealed in the analysis may stem from a stronger sensitivity to SD aspects, which is reflected in previous studies pertaining to significant differences between genders concerning environment-related attitudes and models of behavior (Vicente-Molina *et al.*, 2013), as well as to the impact of gender upon environment-related behavior. For these aspects, it is women who undertake environment-friendly actions more frequently (Levine and Strube, 2012). It is noteworthy that the present study did not reveal statistically significant differences between SD goals and the following variables: grade point average and the field of medical studies. As a consequence, it can be argued that these factors did not diversify dependent variables.

4. Conclusions

Presented results confirm the existence of a gap concerning insufficient ESD at medical universities in Lublin. Diversified results concerning previous ESD (at school, prior to university studies) as well as the marginal scale of SD-related activities undertaken by medical universities enable the development of ESD recommendations for the higher level of education. Medical universities ought to introduce SD-related content into their curricula. Such an approach bears considerable validity because educational institutions were indicated by medical

university students as those chiefly responsible for ESD. However, at the same time, it was revealed that the students possess elementary SD knowledge and are aware of the impact of individuals upon SD. The students indicate familiarity with the term “sustainable development”.

However, they frequently state they are not completely certain as to its exact meaning. Women were significantly more frequently unsure of the meaning than men. This is convergent with the results of other authors who concluded that women had less knowledge pertaining to environmental matters (Al-Naqbi and Alshannag, 2018). It ought to be noted that there exist studies whose results are reverse. They argue that female students indicated deeper SD knowledge (Summers *et al.*, 2004). The students of medical universities associate all of the aforementioned individual aspects with SD with above-average intensity. They predominantly link SD with environmental and economic aspects. Such results are convergent with the works published by e.g. the University of Oxford. Such works indicate that, as regards SD aspects, 87% of students pointed to the predominant significance of environment, 69% referred to economic aspects, and merely 49% connected SD with social development (Azapagic *et al.*, 2005).

Students of medical universities in Poland are familiar with SD goals featured in the 2030 Agenda for SD. The strongest correlation with SD is indicated for goals strictly linked with the natural environment: conservation of terrestrial ecosystems, forests and soil, marine resources, and with combating climate change. On the other hand, the lowest correlation with SD is indicated for social goals such as the eradication of poverty, gender equality, reduction of inequality among countries, access to judicature, prevention of social exclusion. The statistical analysis indicated that, on average, women assigned higher ranks to the individual goals in the agenda. This may stem from a higher sensitivity to environment-friendly aspects, which is reflected in previous studies featured in the literature (Levine and Strube, 2012). In addition, women recognized the need for SD-related knowledge development significantly more frequently than men.

Moreover, women voiced a stronger need for SD knowledge improvement. The present study also revealed significant differences in the correlation between the year of study and the goals such as the eradication of poverty, sustainable management of water resources, and sustainable consumption and production. The analysis of results indicated that the higher the year of study, the higher rank was assigned to the specific objective. Therefore, it can be argued that SD awareness rose as the respondents progressed with their studies. This may stem from the students' experiences or knowledge acquired in the course of self-study. However, this is not the result of education pursued at the university because the respondents argued that such initiatives were missing at medical universities.

The results concerning SD knowledge, as well as available literature, confirm the existence of an educational gap relating to economic and social SD aspects

(Sandoval *et al.*, 2020). The results concerning SD knowledge of medical university students seem to suggest that they possess elementary knowledge. However, no initiatives and university classes which may enhance and mold the knowledge are available. As a consequence, it can be argued that the students' knowledge originated from their pre-university education in the framework of natural science classes, as well as educational programs/ broadcasts in media, and awareness fostered by the surrounding environment, e.g. family and friends.

In light of the present results, teaching content (university curricula and project work) at medical universities ought to be supplemented with SD-related issues. The changes in the curriculum ought to entail the promotion of initiatives fostering the change of students' attitudes. The literature promotes the approach consisting in universities developing, testing and introducing new content, methods and transformational approaches in order to be able to cooperate effectively with the student body and involve students in ESD so that the content of the courses is linked with SD-related goals (Sa and Serpa, 2020, Herranen *et al.*, 2018).

The respondents indicated their learning preference for direct contact with SD-related issues, e.g. those pertaining to the natural environment, and participation in SD-related events. This stems from the fact that personal experience enables improved understanding of the cause-effect relationship behind a specific problem. The students voiced their lowest preference for traditional learning methods such as meetings, seminars, printed materials. The respondents also indicated the significance of modern teaching methods, e.g. e-learning platforms, which are of vital importance at every educational level during the COVID-19 pandemic (Sa and Serpa, 2020).

The present study has certain limitations. Due to the fact that Polish medical universities educate predominantly in the fields of medicine, dentistry, nursing and midwifery, the sample was dominated by the students of these fields and majors. The remaining fields of study are underrepresented because the number of students representing these at the universities is low. Therefore, the expansion of the sample to include those underrepresented groups seems valid.

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