CONCEPTIONS AND MISCONCEPTIONS ON BLOOD TYPES

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ABSTRACT

The human red blood cells can create a vast change in the health of every individual. That is why blood production is very complex. This research work aimed to investigate conceptions and misconceptions on gene segregation and interaction particularly on the practical applications of understanding blood types among students, faculty members, and non-teaching staff of Isabela State University-Jones Campus. In this study, a mixed method of research design with both qualitative and quantitative forms was used. There were 161 male and female respondents in the study. Majority of the respondents were single, mostly students, and 19 to 23 years of age; 42% were male and 58% were female. The most common blood type was O, followed by AB, B, and A. However, only 14% were blood donors. Among the 20-item questions, three items in 2, 6 and 10 showed a significant difference where students had misconceptions more than the teachers and non-teaching staff. Further studies may be undertaken to make genetics courses more appealing and can be easily understood to deliver such lessons particularly on blood types or the ABO system. Also, an improved version of the whole syllabus that incorporated the results of this study may be used in the next semester.

Keywords: Education, History and Philosophy, Genetics, Conceptions, Misconceptions, Biology, Genetics, blood type

INTRODUCTION

Learning competencies/learning outcomes related to blood types have received a lot of attention in academia. In the 21st century, skills in identifying blood types are taught through hands-on activities and educational videos. Students will have the opportunity to practice the concepts and will leave with newfound knowledge of blood types. Similarly, many of these misunderstandings and misconceptions are used as ammunition in the public sphere to attack scientific knowledge and discovery. It must be remembered however, that the role of science faculty members is not only to teach its content, but also to provide students with the necessary background knowledge and skills for this pursuit and to help motivate students [Koballa, T. Kemp., A. Evans, R. 1997].

It is also worth noting that other brain function and structure parameters associated with learning processes and academic achievement are highly heritable (Xu et al., 2017). Similarly, it is worth noting that the manifestation of a specific trait, the phenotype, is dependent not only on genetic background and environment, but also on their interaction. Some phenotypes, such as blood group in the ABO system, exhibit only genetic variation with no environmental influences. Others, such as height, are influenced by genetic, environmental, and interactive factors.

Consequently, blood types are necessary for survival and emergencies because this is based on whether or not certain proteins are on the red blood cells. Blood is often grouped according to the ABO blood typing system like Type A, Type B, Type AB (the universal recipient) and Type O (Universal donor). With the surge of COVID - 19, blood supply has a high demand for transfusion to lengthen the life of the individual (Staff, 2021).

OBJECTIVES OF THE STUDY

This study aimed to 1). determine the conceptions and misconceptions related to blood

groups that include type A, type B, type AB, and type O, 2). Identify the proportion of those with (a) conceptions and (b) Misconceptions between students, faculty, and non-teaching staff, 3). Find out the proportion of respondents with misconceptions across their profile variables.

METHODOLOGY

In achieving the objectives of this study, the researcher employed a mixed method of research. This design is a combination of both qualitative and quantitative forms so that the overall strength of the study is greater than either of the two forms. There were 161 respondents in this study in which, 140 were students and 21 faculty and non-teaching staff of Isabela State University- Jones Campus. This research was employed on the basis of a simple random sampling technique. For this study, a total enumeration sampling and self-reporting questionnaire were used to gather data/information to investigate the conceptions and misconceptions on gene segregation and interaction particularly on the practical applications of understanding blood types. The questions were made through online questions on misconceptions of blood types entitled "Debunking the Blood Types Myth (CartelBloodcare, 2016). These questions were all tackled and found in the syllabus. Through this, the instrument was then validated by professionals who are experts in test construction to assess the face and content validity of the instrument before its implementation. The data were collected through surveys and questionnaires. The questionnaires were sent to the respondents via google form after thoroughly explaining the tabulations. The study revolved around the misconceptions on gene segregation and interaction particularly on the practical applications of understanding blood types. All data were imported and analyzed in SPSS Statistics version 26. In this procedure, the conceptions and misconceptions on blood types were detected on the items for which the interpretation of misconceptions were as follows: 0.80-1.00 - very strong (VS); 0.60-0.79 - Strong (S); 0.40-0.59 - Moderate (M); 0.20-0.39 - Weak (W) and 0-0.19 – very weak (VW) Haron, et al. (2012). This was then used from the research made by Soeharto et al. (2019) entitled: *"A Review of Student's Common Misconceptions in Science and their Diagnostic Assessment Tools*." Conversely, the effect size indices used for this test and for follow-up comparisons on categories were Cramer's *V* and odds ratio, respectively. Cramer's *V* was interpreted based on Cohen's (1988) guidelines of *r*-related effect size indices: values at 0.10 means small difference, 0.30 means moderately large difference, and 0.50 means large difference Li, S. et.al. (2020).

RESULTS AND DISCUSSIONS

1. Profile of Respondents

Table 1
Frequency distribution for the profile of respondents

Profile	Frequency	Percent
Age		
18 years and below	18	11.18
19 to 23 years	122	75.78
24 years and above	21	13.04
Gender		
Male	68	42.24
Female	93	57.76
Marital status		
Single	147	91.30
Married	14	8.70
Blood type		
A	18	11.18
B	28	17.39
AB	46	28.57
O	69	42.86
Blood donor?		
No	138	85.71
Yes	23	14.29
Categorical status		
Student	140	86.96
Faculty and staff	21	13.04
Total	**161**	**100.00**

Results from Table 1 show that majority of the respondents were single with 147 or 91.30%, and followed by 140 or 86.96%. Results also reflect that next high group was on age bracket of 19 to 23 years of age with 122 or 76%. In terms of gender, 42% (68) were male and 58% (93) were female.

On the other hand, the most abundant blood type was O with 69 or 42.86%, followed by AB with 46 or 28.57%, B with 28 or 17.39%, then A with 18 or 11.18%. However, only 14% or 23 of them were blood donors. According to redcrossblood.org, 2020 revealed that type O negative blood is the universal blood type required for emergency transfusions and for immune-deficient infants.

2. Conceptions and Misconceptions on Blood Types among the Students and Faculty and Non-teaching Staff

It is surprising that not only the students had misconceptions but even the faculty and non-teaching. Generally, results show that majority of the responses garnered a strong degree of misconceptions as evidenced for the items 2,3, 6,7,8, and 15 between the students and faculty and non-teaching with the mean of 0.61, 0.60, 0.60, 0.67, 0.72, and 0.61, respectively which means that the misconceptions were based on the diets, the food that they eat and in their personality assessment.

Likewise, results show moderate misconceptions were on items 5, 11, 12, 17, and 18 with the mean score of 0.44, 0.45, 0.54, 0.47, and 0.40 respectively, which means that their misconceptions were based on bitten by mosquitos, donating blood and the number of measurements of blood. Additionally, weak misconceptions were on items 4, 9,10, 13, 14, and 16 with the mean score of 0.29, 0.26, 0.30, 0.21, 0.22, and 0.30 respectively, which means that their misconceptions were about illnesses and hospitalization.

Lastly, a very weak degree of misconceptions was given on items 1, 19, and 30 with the mean score of 0.18, 0.15, and 0.15, respectively, which means that computations using the Punnett square are required to answer these items. Furthermore, among the 20-item questions, the students had a significant and a higher number of misconceptions while the faculty and non-teaching had a lower number of misconceptions wherein misconceptions seemed to center mostly on diets and personalities related to specific blood types and the chance of infection upon blood donation. This agrees with the study made by Chi (2008), that students' knowledge consists often of an inter-relative system of false and correct beliefs. Meanwhile, on significant differences, among the 20 items given, 17 items were found to have students, faculty and non-teaching staff with no significant difference in terms of their conceptions and misconceptions. However, the following three items showed a significant difference where students had misconceptions more than the faculty and non-teaching staff.

2. An individuals' personality is based on blood type.	Student	152	.3421	0.6579	S	.47598	9.786**	.002	f>s
	Faculty & Non-Teaching	22	.6818	0.3182	W	.47673			
	Total	174	.3851	0.6149	S	.48801			

6. Type A blood should stick with vegetarian nutrition while your Type O friends should eat as much meat-based protein.	Student	152	.3684	0.6316	S	.48397	4.022*	.046	f>s
	Faculty & Non-Teaching	22	.5909	0.4091	M	.50324			
	Total	174	.3966	0.6034	S	.49059			

10. There is no substitute for human blood.	Student	152	.6579	0.3421	W	.47598	8.272**	.005	f>s
	Faculty & Non-Teaching	22	.9545	0.0455	VW	.21320			
	Total	174	.6954	0.3046	W	.46157			

The findings in the present study found similarity to the findings made in Ramesh et al. (2020) work which reveals that very few students' understanding of science concepts was correct and most of the students' conceptual understanding was incorrect. Course textbooks are one source of misunderstandings (Güngör & zgür, 2009). Furthermore, a diagram from science textbooks was used, and it was discovered that many students' interpretations of this diagram contradict scientific knowledge. Despite the fact that the study sample consisted of prospective biology teachers, all of their misconceptions appeared to be reinforced by such materials in science textbooks. Hence it is the main responsibility of teachers to reduce students' misconceptions in the very beginning so that it helps them to learn a higher level of concepts.

3. Conceptions and Misconceptions on Blood Types Across Profile

Table 3 presents the desired statistics for this research question. There was no statistically significant difference in the proportion of respondents who had misconceptions based on

gender, c_G^2 = 0.29, p = .633, V = .042, blood type, c_G^2 = 7.10, p = .068, V = .212, and donorship, c_G^2 = 0.60, p = .503, V = .061.

Table 3
Descriptive and Inferential Statistics on the Difference in the Proportion of Respondents with Misconceptions across Profile

Profile	Descriptive		Test of difference		
	f	%	c_G^2	*P*	*V*
Age					
18 years and below	7	38.89	6.04	.048*	.194S
19 to 23 years	63	51.64			
24 years and above	5	23.81			
Gender					
Male	30	44.12	0.29	.633ns	.042
Female	45	48.39			
Marital status					
Single	74	50.34	9.59	.002*	.244S
Married	1	7.14			
Blood type					
A	5	27.78	7.10	.068ns	.212S
B	9	32.14			
AB	26	56.52			
O	35	50.72			
Blood donor?					
No	66	47.83	0.60	.503ns	.061
Yes	9	39.13			
Categorical status					
Student	70	50.00	5.03	.034*	.177S
Faculty and staff	5	23.81			

*Note: *: Significant ns: Not significant*
S: Small difference

However, there was a significant difference in the proportion of respondents who had age related misconceptions., c_G^2 = 6.04, p = .048, V = .194, marital status, c_G^2 = 9.59, p = .002, V = .244, and categorical status, c_G^2 = 5.03, p = .034, V = .177. This means that somewhere across the categories of age, marital status, and categorical status, at least one category had significantly higher or lower number of respondents with misconceptions on blood type. Despite reaching statistical significance, the difference was still small. These findings are in line with the study of Boshuizen et al. (2020) stated that differences relate to taking responsibility for one's own health versus taking responsibility for the health and disease of others, and for scientific knowledge (Mieg & Evetts, 2018).

Table 4
Odds Ratio for Pairwise Comparisons on Age, Marital Status, and Categorical Status

Profile comparisons			*OR*	OR^{-1}
Age				
18 years and below	vs.	19 to 23 years	0.60	1.68
18 years and below	vs.	24 years and above	2.04	0.49
19 to 23 years	vs.	24 years and above	3.42	0.29
Marital status				
Single vs. Married			13.18	0.08
Categorical status				
Student vs. Faculty and staff			3.20	0.31

Using odds ratio to compare the likelihood of misconceptions per category (*Table 4*), it was found that respondents with ages 18 years and below had about the same likelihood in having misconceptions compared to those with ages 19 to 23 years (*OR* = 1.68), but they were also twice more likely to have misconceptions when compared to those with ages 24 years and above (*OR* = 2.04). Moreover, respondents with ages 19 to 23 years were about thrice more likely to have misconceptions compared to those with ages 24 years and above (*OR* = 3.42). In terms of marital status, single respondents were about 13 times

more likely to have misconceptions on blood types compared to married respondents (*OR* = 13.18). Finally, in terms of categorical status, students were about thrice more likely to have misconceptions compared to faculty and staff members (*OR* = 3.20).

This is consistent with Mustami's (2016) findings that there are misconceptions in biology textbooks; therefore, both teachers and students who use such textbooks will have misconceptions. Similarly, this attributed to the erroneous understanding to the inadequacy of information students received from their learning experiences and peers. Furthermore, the findings were consistent with recent studies that have shown that learners had difficulty understanding science subjects, and this difficulty created a significant challenge for students to learn the next level (Bahar, 2003). Misconception affects all levels of learners, beginning with primary school.

The majority of the respondents were single, mostly students, and 19 to 23 years of age. In terms of gender, 42% were male and 58% were female. O was the most common blood type, followed by AB, B, and A. However, only 14% were blood donors.

In general, there were several items where the total degree of misconceptions had an interpretation of strong. These were on items 2, 3, 6, 7, 8, and 15. Items 5, 11, 12, 17, and 18 have moderate misconceptions. Additionally, weak misconceptions were on items 4, 9,10, 13, 14, and 16 and lastly, in the very weak degree of misconceptions, the items were 1, 19, and 30.

Among the 20 items presented, 17 items were found to have no significant difference in conceptions and misconceptions of students, teachers and staff. However, three items 2, 6 and 10 showed a significant difference where students had misconceptions more than the teachers and staff wherein misconceptions seem to center mostly on diets and personalities related to specific blood types and the chance of infection upon blood donation.

The proportion of respondents who had misconceptions did not differ significantly across gender, blood type, and donorship, but there was a significant difference with respect to age, marital status, and categorical status.

CONCLUSIONS

Blood and its components are extremely valuable. As far as we know, the absence of genetic understanding about blood is a global issue. Genetics misconceptions were attributed to challenges in genetics textbooks, instructional methods, teachers' cultural beliefs and practices, and the abstractness of genetics could pave the way for blood type conceptions.

RECOMMENDATION

To deliver such lessons, particularly on blood types or the ABO system, there is a need to make genetics courses/subjects more appealing and easily understood by exploring hands-on and minds-on activities that are pragmatic and practical, so that misconceptions are transformed into conceptions. To improve implementation, genetic courses with high-quality textbooks, instructional methods, lecturer guides, and experiments that actively engage students in the learning process may be provided.

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