Original Article

Type 2 Diabetes Mellitus (T2DM) Knowledge Among Senior High School Students Before and After a Structured Health Education Intervention at Canossa College – San Pablo City, Inc.

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Abstract. Type 2 Diabetes Mellitus is a growing public health concern, often developing gradually due to insulin resistance and remaining undiagnosed until complications arise. This study aimed to enhance senior high school students' knowledge of Type 2 Diabetes Mellitus (T2DM) and increase preventive awareness, thereby supporting Sustainable Development Goals 3 on good health and well-being, and Goal 4 on quality education and health literacy. Using a quantitative, pre-experimental, one-group pretest-posttest design, 185 students at Canossa College in San Pablo City completed a validated questionnaire assessing their knowledge of Type 2 Diabetes Mellitus (T2DM), including its definition, symptoms, risk factors, complications, and preventive measures. The educational intervention consisted of structured group discussions, take-home pamphlets, and posters displayed in the school canteen, a high-traffic area to ensure repeated exposure. Results showed significant improvements across all domains: knowledge of T2DM diagnosis increased from 35.14% to 73.51% (38.37% improvement, p = 0.048), understanding of risk factors improved from 36.76% to 69.19% (32.43% improvement, p = 0.008), and awareness of complications such as liver involvement rose from 23.24% to 57.84% (34.59% improvement, p = 0.008). These findings indicate that multi-modal school-based health education effectively enhances adolescents' health literacy and corrects misconceptions related to Type 2 Diabetes Mellitus. However, the study evaluated knowledge outcomes only and did not directly measure behavioral or lifestyle changes. While generalizability is limited to a single institution, the study highlights the value of integrating structured T2DM education into school curricula to improve health knowledge and preventive awareness and support achievement of SDGs 3 and 4.

Keywords: Health literacy; Senior High School; Type 2 Diabetes Mellitus (T2DM).

Type 2 Diabetes Mellitus (T2DM) exists as a primary non-communicable disease (NCD) that causes both worldwide health problems and fatalities while impeding healthcare systems. The condition results in elevated blood sugar levels because the body becomes unable to use insulin properly and fails to produce sufficient insulin, which distinguishes it from Type 1 Diabetes Mellitus, which develops through complete insulin

deficiency (World Health Organization, n.d.). T2DM begins without symptoms, which leads to delayed diagnosis while increasing the likelihood of developing complications such as heart disease, kidney problems, nerve damage, and vision loss (Galicia-Garcia et al., 2020; Khan et al., 2020). The World Health Organization reports that low- and middle-income countries face greater challenges in diagnosing medical conditions because their citizens lack access to preventive healthcare and essential medical education (World Health Organization, 2023).

T2DM now affects over 462 million people worldwide, representing approximately 6.28% of the total population, and its incidence continues to increase across all age groups (Khan et al., 2020). The Philippines reported a diabetes prevalence rate of 6.0% in 2013, while forecasts predict that over 6 million Filipinos will develop T2DM by 2035 (World Health Organization, 2023). Local data further indicate that diabetes is among the leading causes of mortality in many urban centers, including San Pablo City, thus underscoring the urgency of the problem (City Health Office of San Pablo City, 2024). The rising number of adolescents developing T2DM has become a significant issue because of their inactive lifestyles and poor dietary habits, and the growing prevalence of obesity (Pulimeno et al., 2020; Pramanik et al., 2024). Youth-onset T2DM runs a more aggressive disease course and earlier onset of complications than adult-onset cases (Valaiyapathi et al., 2020).

Health education helps prevent T2DM in adolescents. Schools are ideal settings for promoting health literacy, as students develop knowledge, attitudes, and behaviors there (Pulimeno et al., 2020; American Diabetes Association, 2022). Studies show structured diabetes education improves knowledge, preventive behavior, and health outcomes (Shiferaw et al., 2021; Wang et al., 2025). Interactive tools such as group discussions and visual aids engage students and help them retain health information (Lago, 2021; Chikendu, 2022). However, Philippine secondary schools rarely offer structured education on T2DM, and little data exists on what adolescents already know.

Currently, no formal program exists within Canossa College–San Pablo City Inc. to assess or systematically improve senior high school students' understanding of T2DM. This absence of data creates a gap in school-based local research on adolescent knowledge of diabetes and the effectiveness of educational interventions addressing this issue. Hence, the present study aims to assess senior high school students' knowledge of T2DM regarding its definition, risk factors, symptoms, complications, and management, and to evaluate the effectiveness of a structured educational intervention comprising group discussions, posters, and pamphlets. Expected outcomes of this study include contributing to evidence-based school health programs that strengthen adolescent health literacy and support preventive efforts early on to address the growing burden of T2DM in the Philippines.

This study is theoretically informed by Dr. Nola Pender's Health Promotion Model (HPM) and Rudolf Cymorr Kirby P. Martinez's On Health and Wellness Theory, which served as conceptual frameworks guiding the general orientation of the study rather than as directly measured variables. Pender's HPM emphasizes that individual characteristics and health-related cognitions influence health-promoting behaviors. In the present study, the model was used to contextualize the importance of health knowledge as an initial component of health promotion, while specific theoretical constructs such as self-efficacy and perceived barriers were not directly measured. Accordingly, the study assessed students' demographic profiles and knowledge levels as observable indicators relevant to health education.

Martinez's On Health and Wellness Theory further supports the emphasis on health knowledge as a foundation of wellness, highlighting that informed awareness and lifestyle understanding contribute to sustained well-being. Within this research, the theory provided a philosophical basis for emphasizing knowledge acquisition as a preliminary step toward health consciousness rather than evaluating broader wellness outcomes. Anchored in this perspective, the study views increased knowledge of T2DM as a critical step toward fostering health awareness and preventive orientation among adolescents. Thus, both theories served as guiding perspectives for interpreting findings on knowledge improvement following the educational intervention.

Guided by these theoretical perspectives, the study sought to answer the following research questions:
1. What is the demographic profile of the senior high school students of Canossa College–San Pablo City Inc. in terms of age, sex, strand, body mass index (BMI), and lifestyle?
2. What is the level of knowledge of the senior high school students on Type 2 Diabetes Mellitus before the educational intervention in terms of definition, symptoms, risk factors and complications, and prevention and management?

3. What is the level of knowledge of the senior high school students on Type 2 Diabetes Mellitus after the educational intervention in terms of definition, symptoms, risk factors and complications, and prevention and management?

4. Is there a significant difference between the students' level of knowledge on Type 2 Diabetes Mellitus before and after the educational intervention?

5. Is there a significant relationship between selected demographic variables (age and sex) and the level of knowledge of the senior high school students on Type 2 Diabetes Mellitus?

6. Based on the findings, what improvements can be proposed to enhance the educational intervention aimed at increasing students' knowledge of Type 2 Diabetes Mellitus?

Methodology

Research Design

A quantitative pre-experimental one-group pretest–posttest design was selected to measure changes in students' knowledge. The questionnaires administered before and after the intervention provided data on the understanding of Type 2 Diabetes Mellitus (T2DM). Hence, the design was appropriate for verifying whether the educational intervention effectively improved the knowledge of the single group of participants.

Participants and Sampling Technique

One hundred eighty-five senior high school students aged 16 to 18 years from Canossa College – San Pablo City Inc., enrolled in the ABM, HUMSS, and STEM strands, were purposively sampled. Students were selected based on age and strand, considering that older adolescents are at a higher risk of future T2DM due to lifestyle factors (Nikolopoulou, 2022). Adolescents who did not complete both the pretest and posttest were excluded from the final data set.

Research Instrument

The data were collected using a modified version of a questionnaire adapted from Ubangha et al. (2016) to assess the respondents' demographics, general knowledge about diabetes, risk factors, symptoms, and affected organs. The original author permitted the use of the instrument. Content validity was determined through expert review, and pilot testing with 30 students showed very good reliability (KR-20 = .851; subscales = .791-.902).

Data Gathering Procedure

Data collection began after approval was obtained from the City Health Office, school authorities, and the author's university. The educational intervention was developed to address the increasing cases of Type 2 Diabetes Mellitus (T2DM) among young people through interactive visual health education methods validated by prior research. The content and teaching strategies were informed by evidence that structured diabetes education programs improve knowledge, self-care abilities, and preventive outcomes (Shiferaw et al., 2021). Health professionals evaluated the intervention, which covered T2DM definition, symptoms, risk factors, complications, and preventive strategies, ensuring accuracy, age-appropriateness, and suitability for senior high school students.

On February 10, 2025, the pretest was administered to seven sections of senior high school students, while the eighth section was unavailable due to a school retreat. This section's pretest was rescheduled to February 17, 2025, to ensure that all participants could be assessed without missing instructional content. After the pretest on February 10, the same seven sections participated in a 30-minute structured group discussion, which used standardized PowerPoint presentations, real-life examples, short case scenarios, and age-appropriate language to enhance comprehension.

On February 11, 2025, educational posters were displayed in the school canteen, a high-traffic area, to provide continuous visual reinforcement. On February 12, 2025, pamphlets summarizing discussion points and preventive measures were distributed to the same seven sections during dismissal, serving as take-home materials for further review. On February 17, 2025, the remaining section received the pretest, followed by the same structured discussion intervention. Pamphlets for this section were distributed on February 19, 2025, aligning with the dismissal schedule. Posttests were conducted on February 19, 2025, for the first seven sections, and on February 26, 2025, for the remaining section, maintaining a 9-day interval between pretest and posttest for both groups. This interval ensured sufficient exposure to the multi-modal intervention while keeping the schedule consistent across all participants, thereby allowing comparability of pretest and posttest results.

The structured discussions incorporated guided question-and-answer sessions and short quizzes to encourage active participation, while facilitators provided instant feedback to correct misconceptions and reinforce accurate responses. The multi-modal intervention, combining interactive discussion, visual presentation, printed reinforcement materials, and repeated poster exposure, was designed to enhance understanding, retention, and preventive health awareness. All procedures occurred in a supervised school setting to maintain consistency in testing and minimize external influences.

Data Analysis Procedure
The Kuder-Richardson Formula 20 (KR-20) was used to establish instrument reliability. Descriptive statistics summarized categorical data. The Wilcoxon Signed-Rank Test was used to compare pretest and posttest results, given the non-normal distribution of the data (Holmes, 2020). Chi-square tests of independence explored relationships between demographic variables (age and sex) and T2DM knowledge levels (Rahman et al., 2020).

Ethical Considerations
The study followed PHREB (2022) ethical guidelines for research involving minors. Parental consent and student assent were obtained, participation was voluntary, and data were kept confidential and anonymous. All institutional requirements at Canossa College–San Pablo City Inc. were met, and no incentives were offered to avoid coercion.

Results and Discussion

Demographic Profile
Table 1 presents the demographic profile of the 185 senior high school students of Canossa College – San Pablo City, Inc. Most respondents were 17 years old, followed by those aged 18 and 16, indicating that the participants were largely in late adolescence. This stage of development is considered critical for the formation of health beliefs and behaviors, particularly those related to chronic disease prevention (Mohamad et al., 2021). Adolescence is also a transitional phase in which individuals begin to develop independent lifestyle choices, making this age group an appropriate target for health education interventions aimed at preventing non-communicable diseases such as Type 2 Diabetes Mellitus (T2DM).

Table 1. *Profile of the respondents*

Profile	Frequency	Percentage (%)
Age		
15	0	0.00%
16	39	21.08%
17	88	47.57%
18	58	31.35%
Sex		
Male	76	41.08%
Female	109	58.92%
Strand		
STEM	126	68.11%
HUMSS	28	15.14%
ABM	31	16.76%
Body Mass Index		
Underweight	41	22.16%
Normal Weight	94	50.81%
Overweight	33	17.84%
Obesity	17	9.19%

Female respondents comprised a larger proportion of the sample than males. Most students were enrolled in the STEM strand, followed by ABM and HUMSS. Despite their academic orientation, more than one-fourth of the respondents were classified as overweight or obese based on BMI. This finding suggests that academic specialization alone does not necessarily translate into healthier lifestyle practices or adequate health awareness. The research demonstrates that academic exposure does not lead to healthy behaviors and underscores the need for early health education programs to reduce lifestyle-related risks of Type 2 Diabetes Mellitus (Kusumawati et al., 2024; Valaiyapathi et al., 2020).

Table 2. *Profile of the Subjects When Grouped According to Lifestyle – Part I*

Lifestyle	Frequency	Percentage (%)
Ever Smoked Cigarette/E-Cigarette		
Yes	49	26.49%
No	136	73.51%
Ever Drank an Alcoholic Drink		
Yes	119	64.32%
No	66	35.68%
Does your diet include carbohydrates?		
Yes	175	94.59%
No	10	5.41%

Table 2 shows that the respondents exhibited specific lifestyle patterns, including smoking, alcohol consumption, and carbohydrate intake. A notable proportion of students reported smoking cigarettes or e-cigarettes, while alcohol consumption was reported by more than half of the respondents. These behaviors indicate early exposure to modifiable risk factors that, if not addressed during adolescence, may contribute to long-term metabolic and cardiovascular conditions. Research indicates that the adolescent period, which spans 10 to 24 years, shows how the social environment, peer interactions, and media exposure affect risk-taking behaviors (Singh et al., 2021; Green et al., 2020).

Nearly all respondents reported regular consumption of carbohydrate-rich foods such as rice, bread, and pasta. The common Filipino eating patterns, which this study shows, may lead people to believe that eating carbohydrates causes diabetes when this is not true. Instead, the development of diabetes is influenced by overall dietary balance, physical activity, genetic predisposition, and long-term metabolic factors, rather than by carbohydrate intake alone. The public needs structured health education because an improper nutritional context can lead to oversimplified beliefs about T2DM etiology, which strengthen false health beliefs (Nemours Teen Health, 2022).

Table 3. *Profile of the Subjects When Grouped According to Lifestyle – Part II*

Lifestyle	Frequency	Percentage (%)
Days When Fruits Were Eaten		
0	13	7.03%
1 to 2 days	93	50.27%
3 to 5 days	68	36.76%
More than 5 days	11	5.95%
Days When Vegetables Were Eaten		
0	8	4.32%
1 to 2 days	65	35.14%
3 to 5 days	83	44.86%
More than 5 days	29	15.68%
Days of Exercise in a Week		
0	34	18.38%
1 to 2 days	82	44.32%
3 to 5 days	50	27.03%
More than 5 days	19	10.27%
Time Spent Exercising		
0	34	18.38%
10-20	72	38.92%
30	30	16.22%
More than 30 mins	49	26.49%

Table 3 shows that people have different lifestyle patterns, including their fruit and vegetable consumption and exercise habits. Most students reported limited fruit and vegetable consumption, with only a small proportion meeting the recommended intake levels. This indicates a nutritional gap that may reduce the protective effects of diet against chronic diseases. Many students exercised at low levels because they reported infrequent, brief exercise sessions. These lifestyle patterns place students at increased risk for metabolic disorders, including insulin resistance and obesity. The findings suggest limited awareness of the protective role of diet and exercise in preventing chronic diseases and highlight the importance of targeted interventions to promote healthier habits during adolescence (Ahmed et al., 2020; Bondonno et al., 2021; Ismail, 2021). Furthermore, establishing healthy behaviors during adolescence increases the likelihood of sustaining these practices into adulthood, underscoring the importance of early preventive education.

Level of Knowledge on Type 2 Diabetes Mellitus (T2DM) Before Intervention

Table 4 presents respondents' baseline knowledge of the definition, diagnosis, affected population, and treatment of T2DM. While a majority correctly identified the definition of diabetes and the population commonly affected, knowledge regarding diagnosis and treatment was relatively low. Students demonstrated basic knowledge of diabetes detection and treatment, yet failed to apply that understanding in practical situations. These findings indicate the presence of foundational awareness but insufficient depth of understanding prior to the educational intervention. The existing gaps in knowledge result from students relying on informal information sources rather than formal health education programs, underscoring the need for teaching methods that link fundamental health concepts to practical health knowledge (Mayo Clinic, n.d.; CDC, 2023). This baseline result justified implementing a structured school-based educational intervention to address identified knowledge deficiencies.

Table 4. *Baseline Knowledge*

Knowledge	Frequency	Percentage (%)	Rank
Definition of Diabetes Mellitus	127	68.65%	2nd
Cure for Diabetes Mellitus	69	37.30%	3rd
Knowledge of Persons Affected by Diabetes Mellitus	144	77.84%	1st
Diagnosis of Diabetes Mellitus	65	35.14%	4th

Table 5 shows that students had strong knowledge of frequently mentioned risk factors, including unhealthy eating patterns, family medical history, and obesity. Most participants failed to recognize that high sugar or carbohydrate consumption is a risk factor rather than a direct cause of T2DM development. People believe that diabetes only happens because of sugar intake, which leads to a misunderstanding about diabetes that society perpetuates by calling it a "sugar disease." This misconception highlights a critical gap in health literacy among adolescents prior to the intervention. The belief persists because multiple educational programs must convey straightforward information about how T2DM develops in relation to various risk factors (University Hospitals, 2023; Waqas Sami et al., 2022). These results emphasize the need for targeted health education to correct false causal beliefs about diabetes.

Table 5. *Risk Factors*

Risk Factors	Frequency	Percentage (%)	Rank
Eating Too Much Sugar/Carbohydrates	8	4.32%	8th
Unbalanced Diet	168	90.81%	1st
High Blood Pressure	139	75.14%	4th
Infection	94	50.81%	5th
Obesity	146	78.92%	3rd
Family History	156	84.32%	2nd
Drugs	107	57.84%	6th
Physical Activity	68	36.76%	7th
Accident	156	84.32%	2nd

Table 6. *Signs and Symptoms*

Symptom	Frequency	Percentage (%)	Rank
Sugary Urine	22	11.89%	10th
Excessive Urination	139	75.14%	2nd
Generalize Pain	56	30.27%	9th
Tiredness	136	73.51%	4th
Vomiting	107	57.84%	5th
Excessive Stooling	96	51.89%	6th
Repeated Infections	68	36.76%	8th
Fever	87	47.03%	7th
Excessive Thirst	147	79.46%	1st
Excessive Hunger	138	74.59%	3rd

Table 6 shows that students were more familiar with common, observable symptoms, such as excessive thirst and hunger. The students demonstrated a poor understanding of clinical markers, including glycosuria. Students based their knowledge of diabetes on what they could see and hear as common symptoms, rather than using laboratory-tested markers to confirm their understanding. This suggests that prior knowledge was largely experience-based rather than medically informed. The results show that health education should teach both visible symptoms and hidden clinical signs because this knowledge will help people identify health problems and seek medical assistance (Mayo Clinic, n.d.; WebMD, n.d.). The findings further support the necessity of structured

educational discussions to bridge gaps between lay understanding and clinical knowledge.

Table 7. *Complications and Affected Organs*

Complications/ Organ Likely to be Affected	Frequency	Percentage (%)	Rank
Kidney	152	82.16%	1st
Liver	43	23.24%	8th
Poor Wound Healing	139	75.14%	3rd
Lungs	119	64.32%	5th
Infections	127	68.65%	4th
Nerve	97	52.43%	7th
Eyes	109	58.92%	6th
Ears	119	64.32%	5th
Heart	142	76.76%	2nd

Table 7 shows students' fundamental understanding of T2DM-related organ damage and its associated medical issues. Most participants correctly identified the kidneys and heart as affected organs, but only a minority detected liver involvement. The students' knowledge about diabetes complications shows that they connect the disease with commonly known problems, but they do not recognize its extensive body-wide effects. This pattern indicates partial awareness but limited comprehension of the systemic nature of T2DM prior to the intervention. The study needs these essential elements to achieve a more comprehensive understanding of disease and its extended impacts (NIDDK, n.d.; Mayo Clinic, n.d.). These baseline findings justified reinforcing complication-related concepts during the educational sessions.

Level of Knowledge on Type 2 Diabetes Mellitus (T2DM) After Intervention
Table 8 shows that the educational intervention resulted in noticeable improvement in students' knowledge after exposure to the discussion, pamphlets, and poster presentation. The combination of discussion, pamphlets, and posters led to the greatest improvement in knowledge regarding diagnosis and disease definition, according to the study results. The increase in posttest scores indicates enhanced understanding of key T2DM concepts following the intervention. The improvement shows that students gained a better understanding of difficult concepts through clear, structured information that included early detection and self-care (Cleveland Clinic, 2024; CDC, 2023). These findings demonstrate improvement in knowledge acquisition rather than behavioral change, as only cognitive outcomes were measured in the study.

Table 8. *Baseline Knowledge*

Knowledge	Frequency	Percentage (%)	Pretest	Changes	Rank
Definition of Diabetes Mellitus	165	89.19%	127.00 (68.65%)	20.54	3rd
Cure for Diabetes Mellitus	128	69.19%	69.00 (37.30%)	31.89	2nd
Knowledge of Persons Affected by Diabetes Mellitus	156	84.32%	144.00 (77.84%)	6.49	5th
Diagnosis of Diabetes Mellitus	136	73.51%	65.00 (35.14%)	38.37	1st

Table 9. *Risk Factors*

Risk Factors	Frequency	Percentage (%)	Pretest	Changes	Rank
Eating Too Much Sugar/Carbohydrates	105	56.76%	8.00 (4.32%)	52.43	1st
Unbalanced Diet	171	92.43%	168.00 (90.81%)	1.62	8th
High Blood Pressure	156	84.32%	139.00 (75.14%)	9.19	5th
Infection	109	58.92%	94.00 (50.81%)	8.11	6th
Obesity	161	87.03%	146.00 (78.92%)	8.11	6th
Family History	174	94.05%	156.00 (84.32%)	9.73	4th
Drugs	133	71.89%	107.00 (57.84%)	14.05	3rd
Physical Activity	128	69.19%	68.00 (36.76%)	32.43	2nd
Accident	170	91.89%	156.00 (84.32%)	7.57	7th

Table 9 shows that the most significant progress occurred in correcting misunderstandings about sugar and carbohydrate consumption. The study found that risk factors with a strong initial understanding showed minimal change over the course of the research. This pattern suggests that the intervention was particularly effective in addressing misconceptions rather than information already well understood by participants. The study results demonstrate that the intervention achieved its highest effectiveness through targeted educational content, which helped participants develop their health literacy skills. Overall, the findings indicate improved comprehension of multifactorial risk factors for T2DM following the intervention.

Table 10. *Symptoms*

Symptom	Frequency	Percentage (%)	Pretest	Changes	Rank
Sugary Urine	101	54.59%	22.00 (11.89%)	42.70	1st
Excessive Urination	163	88.11%	139.00 (75.14%)	12.97	6th
Generalize Pain	98	52.97%	56.00 (30.27%)	22.70	2nd
Tiredness	158	85.41%	136.00 (73.51%)	11.89	7th
Vomiting	120	64.86%	107.00 (57.84%)	7.03	10th
Excessive Stooling	131	70.81%	96.00 (51.89%)	18.92	4th
Repeated Infections	105	56.76%	68.00 (36.76%)	20.00	3rd
Fever	121	65.41%	87.00 (47.03%)	18.38	5th
Excessive Thirst	167	90.27%	147.00 (79.46%)	10.81	8th
Excessive Hunger	156	84.32%	138.00 (74.59%)	9.73	9th

As presented in Table 10, recognition of previously unfamiliar symptoms such as glycosuria improved substantially after the intervention. Smaller gains were observed for nonspecific symptoms, which may be more difficult to distinguish from other common illnesses. The observed improvements suggest that visual and discussion-based teaching strategies enhanced students' recognition of both common and clinical symptoms. The research shows that visual aids with simplified explanations help people better understand clinical concepts, supporting the use of posters and pamphlets to deliver complex health information (WebMD, n.d.). These results reflect increased symptom-related knowledge following exposure to multimodal educational materials.

Table 11. *Complications and Affected Organs*

Complications/ Organ Likely to be Affected	Frequency	Percentage (%)	Pretest	Changes	Rank
Kidney	167	90.27%	152.00 (82.16%)	8.11	7th
Liver	107	57.84%	43.00 (23.24%)	34.59	1st
Poor Wound Healing	163	88.11%	139.00 (75.14%)	12.97	4th
Lungs	122	65.95%	119.00 (64.32%)	1.62	9th
Infections	153	82.70%	127.00 (68.65%)	14.05	3rd
Nerve	118	63.78%	97.00 (52.43%)	11.35	6th
Eyes	149	80.54%	109.00 (58.92%)	21.62	2nd
Ears	128	69.19%	119.00 (64.32%)	4.86	8th
Heart	163	88.11%	142.00 (76.76%)	11.35	5th

Table 11 shows that participants gained greater knowledge of less commonly recognized complications, including liver involvement, after exposure to the educational intervention. The results showed that participants with baseline knowledge of major medical problems benefited from additional clarification of systemic complications. The improvement indicates a strengthened understanding of the wide-ranging effects of T2DM on different organs. The research shows that targeted teaching methods help students understand the systemic effects of T2DM, which medical professionals need to know for complete disease prevention and management (Mayo Clinic, n.d.; NIDDK, n.d.; ADA, n.d.).

Effect of Educational Interventions on Knowledge
In Table 12, the statistical comparison was conducted using the Wilcoxon Signed Rank test on pretest and posttest scores, which evidenced significant improvements in knowledge ($Z = -1.826$, $p = 0.048$), risk factors ($Z = -2.668$, $p = 0.008$), symptoms ($Z = -2.803$, $p = 0.005$), and complications ($Z = -2.668$, $p = 0.008$). These results indicate that students demonstrated significantly higher knowledge scores after exposure to the educational intervention than at baseline.

Table 12. *Difference Between Pre-Test and Post-Test Results*

	Knowledge	Risks	Symptoms	Complications
Z	-1.826[b]	-2.668[b]	-2.803[b]	-2.668[b]
Asymp. Sig (2-tailed)	.048	.008	.005	.008

a. *Wilcoxon Signed Rank Test*
b. *Based on Negative Ranks*

To further examine the magnitude of change, effect sizes were computed using the formula $r = Z / \sqrt{N}$ (N = 185). The calculated effect sizes were small for general knowledge ($r = 0.13$) and small to moderate for risk factors ($r = 0.20$), symptoms ($r = 0.21$), and complications ($r = 0.20$), indicating meaningful improvements in knowledge following the intervention. These findings support the effectiveness of the educational intervention in enhancing students' knowledge and awareness of Type 2 Diabetes Mellitus concepts. However, interpretation should be limited to cognitive outcomes, as the study did not measure behavioral changes or lifestyle modifications.

Consistent with Pender's Health Promotion Model and Martinez's Health and Wellness Theory, structured educational exposure may increase cognitive readiness for healthier decisions; nonetheless, longitudinal or controlled studies are recommended to determine whether knowledge gains translate into long-term behavioral outcomes.

Relationship Between the Demographic Variables and the Level of Knowledge

Table 13 presents the analysis investigating the relationship between age and sex across three knowledge domains: definition, symptoms, and risk factors. The Chi-square tests showed no statistically significant associations at the 0.05 significance level for any combination. Specifically, for age, the p-values were 0.371 (definition), 0.721 (symptoms), and 0.645 (risk factors), indicating that age groups did not differ significantly in correctness across any profile. Similarly, for sex, the p-values were 0.922 (definition), 0.089 (symptoms), and 0.695 (risk factors), indicating no significant relationship between sex and performance. However, the symptom profile showed a trend toward significance (p = 0.089) that warrants further investigation. These findings suggest that variations in knowledge levels were relatively consistent across demographic groups, indicating that the educational intervention was similarly understood regardless of age or sex. Overall, these results suggest that neither age nor sex had a meaningful impact on participants' responses in any of the assessed knowledge domains.

Table 13. *Relationship Between Students' Age, Sex, and Level of Knowledge on Type 2 Diabetes Mellitus*

Variable	Profile	p-value	Decision	Interpretation
Age	Definition	0.371	Fail to Reject Ho	Not Significant
	Symptoms	0.721	Fail to Reject Ho	Not Significant
	Risk Factors	0.645	Fail to Reject Ho	Not Significant
Sex	Definition	0.922	Fail to Reject Ho	Not Significant
	Symptoms	0.089	Fail to Reject Ho	Not Significant
	Risk Factors	0.695	Fail to Reject Ho	Not Significant

The absence of significant differences suggests that demographic characteristics did not strongly influence baseline knowledge gaps or subsequent improvements in knowledge in this sample. The high proportion of correct responses across all groups also indicates a generally strong performance among participants, minimizing the variability explained by these demographic factors. It is important to note that the analysis examined associations with knowledge outcomes only; therefore, no conclusions can be made regarding differences in health behaviors or lifestyle practices across demographic groups.

Recommendations for Improvement

Table 14 illustrates the preferred learning methods of the students to augment their knowledge on T2DM. The greatest preference was for canteen posters (60.54%), followed by pamphlets (23.24%), while group discussions were least preferred (16.22%). This suggests that students favor visually accessible, continuously available learning materials that are easily integrated into their daily school environment.

Table 14. *Students' Recommended Interventions to Help Them Learn About Type 2 Diabetes Mellitus*

Recommendations	Frequency	Percentage (%)
Given Pamphlet	43	23.24%
Poster in the Canteen	112	60.54%
Group Discussion	30	16. 22%

The findings indicate that ambient and repeated exposure to educational materials may be effective strategies for reinforcing health knowledge without disrupting regular academic routines. Interventions designed around learner preferences may enhance engagement and knowledge retention, underscoring the importance of a learner-centered approach in school-based health education. However, these preferences should be interpreted only in relation to knowledge acquisition, as the present study did not measure behavioral outcomes or long-term lifestyle changes. Future implementations may consider combining preferred visual materials with structured discussions to reinforce knowledge further and support health literacy development among students.

Conclusion

The research demonstrates that structured educational activities, implemented through interactive group discussions and informative pamphlets and posters displayed in high-traffic areas, led to significant improvements in Type 2 Diabetes Mellitus knowledge among senior high school students. The students demonstrated clear gains in medical knowledge, learning about disease definitions, symptoms, risk factors, complications, and prevention methods. The study also showed that participants improved their understanding of less-known risk factors and organ complications after exposure to visual materials and discussion sessions.

These findings indicate the importance of delivering age-appropriate health information in schools to enhance students' knowledge and awareness of T2DM. When students participate in structured learning experiences, they gain knowledge that may inform future health decisions. While this study did not measure actual changes in lifestyle or behavior, the results suggest that improved knowledge could contribute to preventive awareness. Further longitudinal or controlled studies are recommended to determine whether these knowledge gains translate into sustained behavioral outcomes.

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