DEPARTMENT OF INFORMATION TECHNOLOGY::VRSEC

REPORT ON INNOVATIVE DELIVERY METHOD

20IT4303 – ADVANCED DATA STRUCTURES AND ALGORITHMS

A.Y. 2022-23
FLIPPED CLASS ROOM

Name of the Topic: Dynamic Programming Technique

Target Audience: Students of II/IV B.Tech II Semester

Date of activity conducted: 26-04-2023 (Section A), 19-04-2023 (Section B)

No. of students participated : 130

Name of the Faculty : Dr.K.Sita Kumari, Associate Professor
Dr.G.Kalyani, Associate Professor

Objective of the activity:

- Task is mapped to course outcome 2 and CO 3 at K3(apply level) and this task can be used to improve the attainment of CO2 and CO3.
- Understand the concepts of Dynamic Programming technique.
- Understand the principle of dynamic programming technique.
- Understand the problem statement.
- Apply the dynamic programming technique for the given problem statement for providing an optimal solution.

Resources provided to the students before conducting the activity:

- Learning Material
- PPT
- Video Lecture links

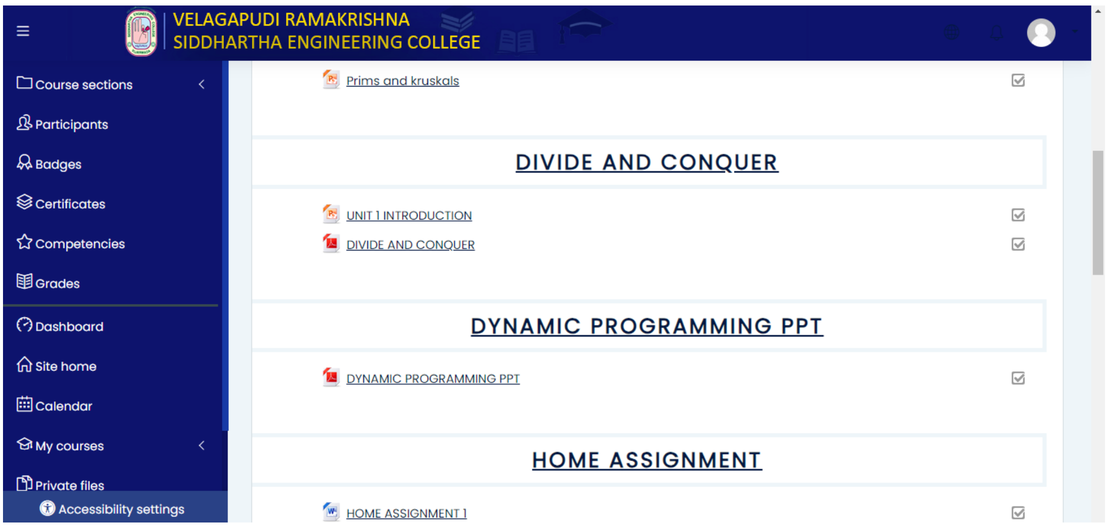

Figure 1: Snapshot of resources provided through Moodle

Introduction:

Good Teaching is one of the most important tasks of the faculty. Students are needed to get understand the concepts clearly and provide solutions to the problems. Flipped classroom is one way to ensure that class time is spent in assimilation, rather than in information transmission.

- Instructor finds or creates videos on topic.
- Students watch video before coming to class.
- Class time is spent in activities and discussions.

The students can understand the topic through the resources provided and get more clarity with the discussions and activity done in groups.

As a part of activity, students are divided into groups of their own with minimum batch size of 4 and task on applying dynamic programming algorithm technique for providing solution to knapsack problem and reliability design problem is given for each group and students are asked to discuss among themselves and solve the problem. One representative from each group is asked to demonstrate the solution for the task given to them.

Execution Plan:

Time management: Class time: **50mins**

- Formation of Groups : 5 mins
- Dissemination of problem statements : 5 mins
- Discussion on knapsack problem and reliability design problem given within the group : 10 mins
- Problem solving : 15 mins
- Demonstration by the students : 10 mins
- Course coordinator summary : 5mins

Expected Outcomes:

The students can be able to

- Understand the problem statement and how to apply dynamic programming technique for the given problem.
- Apply dynamic programming technique for the given problem statement
- Analyze the solution whether it is optimal or not.
- Improve team work and communication skills.

Assessment of the effectiveness of the activity by comparing marks of Assignment II with Assignment I:

Snapshot of task done and the photos of the activity:

DEPARTMENT OF INFORMATION TECHNOLOGY : : VRSEC

II/IV B.TECH SEMESTER II SECTION B

A.Y: 2022-2023

Dt: 19-04-2023

Student Learning activity

Topic : Dynamic Programming – 0/1 Knapsack Problem & Reliability Design Problem

1. Find an optimal solution for following 0/1 Knapsack problem using dynamic programming: Number of objects n = 4, Knapsack Capacity M = 5, Weights (W1, W2, W3, W4) = (2, 3, 4, 5) and profits (P1, P2, P3, P4) = (3, 4, 5, 6)

You are given the following:

→ A knapsack with limited weight capacity

→ Four items each having some weights and values.

The problem states-

which items should be placed into the knapsack such that-

- The value or profit obtained by putting the items into the knapsack is maximum.
- The weight limit of the knapsack doesnot exceed.

0/1 knapsack:

- It doesnot allow to break items. We either take the whole item or don't take it

$$\text{maximize} \sum_{1\le i\le n} p_i x_i \longrightarrow A$$

$$\text{subject to} \sum_{1\le i\le n} w_i x_i \le m \longrightarrow B$$

$$\text{and } 0 \le x_i \le 1, \quad 1\le i\le n \longrightarrow C$$

- The profit and weights are the positive numbers.
- Here, A feasible solution is any set $(x_1, x_2, \ldots, x_n)$ satisfying above rules (B) and (C)

- An optional solution is feasible solution for which rule (A) is maximised.

Given problem:

weights = (2, 3, 4, 5)

profits = (3, 4, 5, 6)

maximum capacity M = 5

No. of objects = 4 (n)

$\Rightarrow S^0 = \{0, 0\}$ (P, w)

$\Rightarrow S^1 = S^0 \cup S_1^0$

$\Rightarrow S_1^0 = \{3, 2\}$

$\Rightarrow S^1 = \{(0,0), (3,2)\}$

$\Rightarrow S_1^1 = \{(4,3)\ (7,5)\}$

$\Rightarrow S^2 = S^1 \cup S_1^1$

$\Rightarrow S^2 = \{(0,0)\ (3,2)(4,3)\ (7,5)\}$

$\Rightarrow S_1^2 = \{(5,4)\ (8,6)\ (9,7)\ (12,9)\}$

$\Rightarrow S^3 = S^2 \cup S_1^2$

$= \{(0,0)(3,2)(4,3)(5,4)\ (7,5)\ (8,6)\ (9,7)\ (12,9)\}$ not feasible

$\Rightarrow S^3 = \{(0,0)\ (3,2)\ (4,3)\ (5,4)\ (7,5)\}$

$S_1^3 = \{(6,5)\ (9,7)\ (10,8)\ (11,9)\ (13,10)\}$

$S_1^3 = \{(6,5)\}$

$S^4 = \{(0,0)\ (3,2)(4,3)(5,4)(6,5)(7,5)\}$

The Highest profit vector (7,5)

Since it is derived from S^3,

Here $x_3 = 1$ & $x_4 = 0$

Now subtract (4,3) from (7,5)

we will get (3,2)

Since it is derived from S^2

$x_2 = 1$ & $x_3 = 0$

Now subtract (3,2) from (3,2)

$\Rightarrow (3,2) - (3,2)$

$\Rightarrow (0,0)$

$\Rightarrow x_1 = 1$ since it is derived from S^1.

Hence the resultant vector = $\{1, 1, 0, 0\}$

2. Design a three stage system with device types D1, D2 and D3. The costs are $30, $15 and $20 respectively. Reliability is 0.9, 0.8 and 0.5. The total cost of the system must not be more than c=$105.

In Reliability design, the problem is to design a system that is composed of several devices connected in series.

Say we are to design 3 stage systems with devices D1, D2, D3 and costs of $30, $15 and $20. Respectively. The cost of this system is to be no more than $105. The reliability of each device type is 0.9, 0.8, 0.5

Devices	Cost	Reliability	Max. number of devices
D1	30	0.9	2
D2	15	0.8	3
D3	20	0.5	3

- Total cost used = 30 + 15 + 20 = 65
- Available amount = 105 − 65 = 40

$(c - (c1 + c2 + c3)) / c2 = 1 + 1 \cong 2$

- Maximum number of additional D1 devices we can purchange = 40/30 = 1

- Maximum number of additional D2 devices we can purchase = 40/15 = 2
- Maximum number of additional D3 devices we can purchase = 40/20 = 2

Let $S_0 = \{(1,0)\}$

$S_1 = (0.9, 30)$

malfuction of D1 device = 1.0 - 0.9 = 0.1

Relialbility of two D1 devices = 1 - 0.1 * 0.1 = 0.99

$S_{21} = \{(0.99, 60)\}$

$S1 = \{(0.9, 30), (0.99, 60)\}$

$S_{12} = (0.72, 45), (0.792, 75)$

Reliability of two D2 devices = 1 - (1 - 0.8) 2 = 0.96

$S_{22} = \{(0.864, 60)\}$

The tuple (0.9504, 90) is eliminated because we cannot purchase a D3 device with the remaining amount of \$15. Reliability of three D2 devices = (1 - 0.8) 3 = 0.992

$S_{32} = \{(0.8928, 75)\}$

the tuple (0.792, 75) is eliminated as the tuple (0.864, 60) dominates (0.792, 75).

$S2 = \{(0.72, 45), ((0.864, 60), (0.8928, 75)\}$

$S_{13} = (0.36, 65), (0.432, 80), (0.4464, 95)$

Reliability of two D3 devices $= 1-(1-0.5)2 = 0.75$

$S_{32} = \{(0.54, 85), (0.648, 100)\}$

Reliability of three D3 devices $= (1-(1-0.5)^3) = 0.875$

$S_{33} = \{(0.63, 105)\}$

$S3 = \{(0.36, 65), (0.432, 80), (0.54, 85), (0.648, 100)\}\}$

Tracking back through S_i^j's , we can determine that 1 D1 device, 2 D2 devices and 2 D3 devices give the Highest reliability

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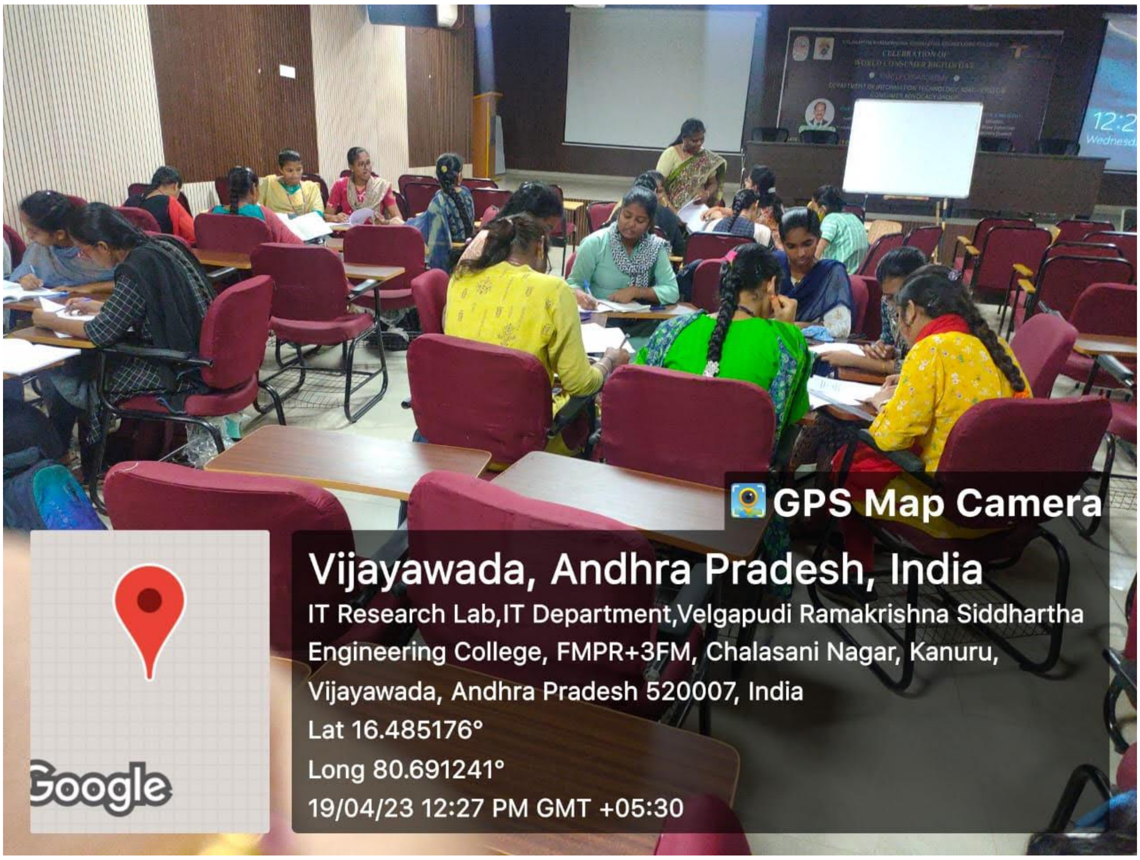
Team Members:

1. S.Bhavana	218W1A12B1	S.Bhavana
2. N.Mahasvi	218W1A12A3	N.Mahasvi
3. K.karuna	218W1A1286	Karuna Katta
4. K.chandana	218W1A1288	K.chandana
5. V.Manaswini	218W1A12C8	ManaSwini
6. P.Keerthana	218W1A12A6	P.keerthana
7. N.swathi	218W1A12A5	Swathi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IT Research Lab,IT Department,Velgapudi Ramakrishna Siddhartha
Engineering College, FMPR+3FM, Chalasani Nagar, Kanuru,
Vijayawada, Andhra Pradesh 520007, India
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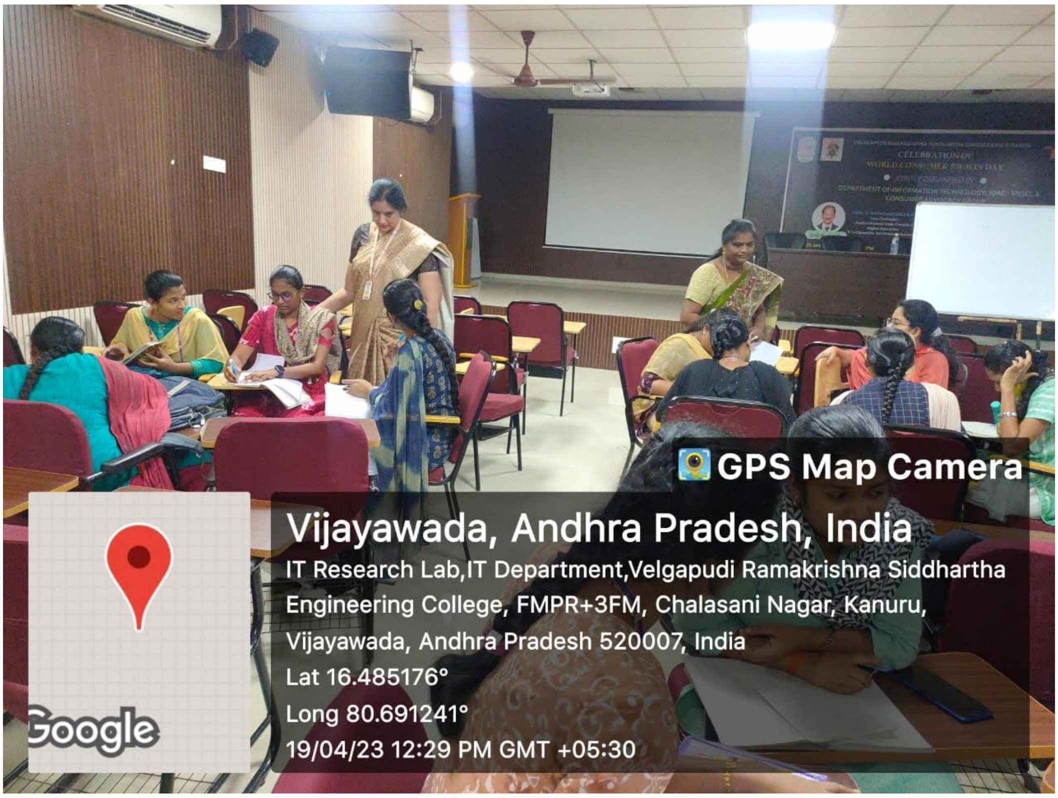
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Engineering College, FMPR+3FM, Chalasani Nagar, Kanuru,
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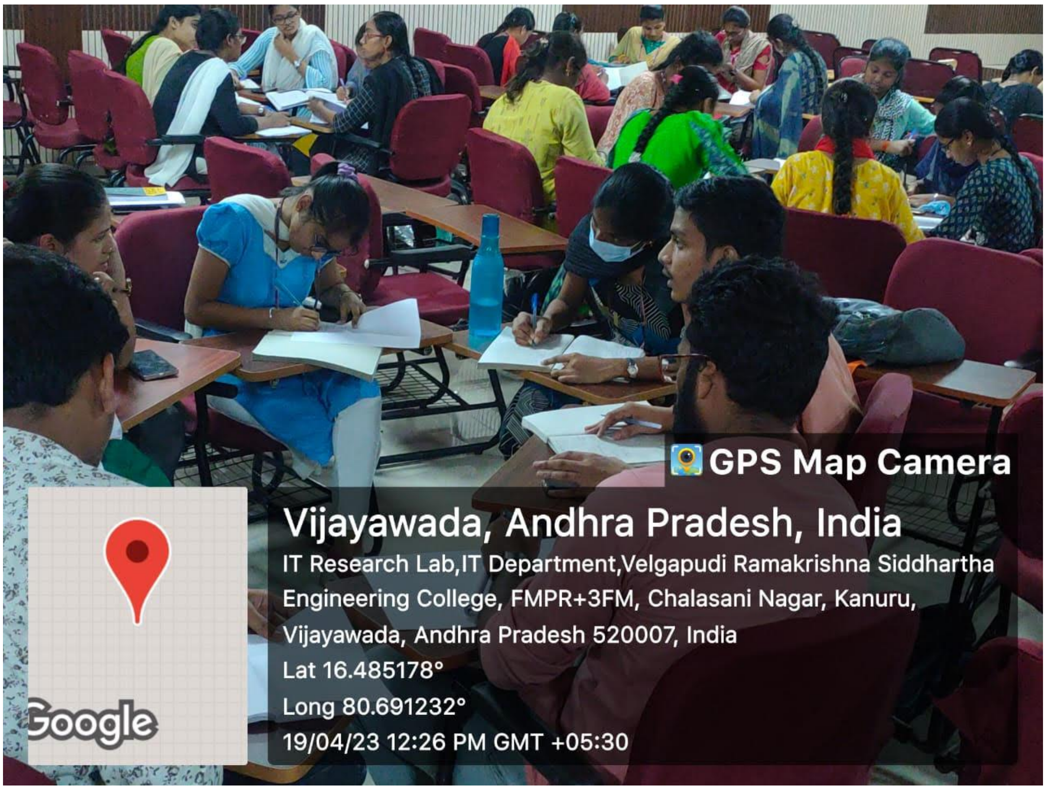
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IT Research Lab,IT Department,Velgapudi Ramakrishna Siddhartha Engineering College, FMPR+3FM, Chalasani Nagar, Kanuru, Vijayawada, Andhra Pradesh 520007, India
Lat 16.485178°
Long 80.691232°
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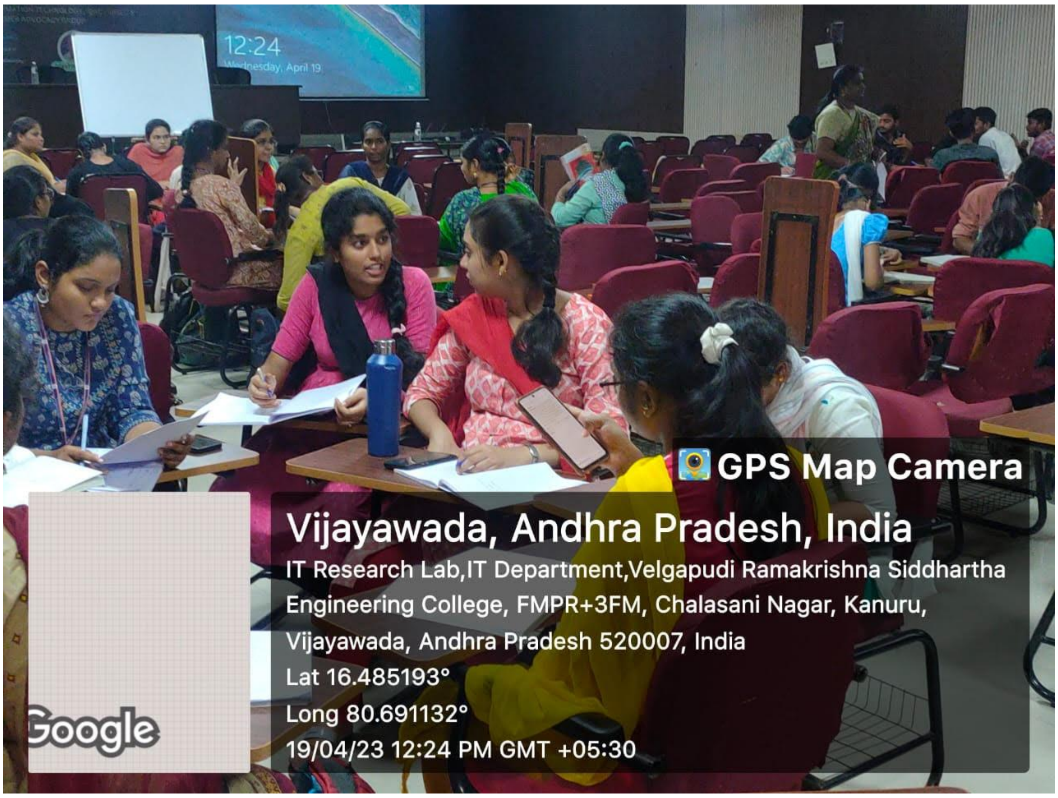
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Long 80.691132°
19/04/23 12:24 PM GMT +05:30
Google

Students working in teams to find the solution for given task

Register No	Assessment before activity Assignment I marks	Assessment after activity Sessional II marks	Impact (Place a tick and state the % of impact)			
			Negative change	No change	Improvement	%
218W1A1201	7	8			✓	
218W1A1202	8.5	8.5		✓		
218W1A1203	6	8			✓	
218W1A1204	8.5	12			✓	
218W1A1205	9	11.5			✓	
218W1A1206	9	11			✓	
218W1A1207	8.5	11			✓	
218W1A1218	7	11.5			✓	
218W1A1209	9	7	✓			
218W1A1210	7.5	10			✓	
218W1A1211	5.5	7.5			✓	
218W1A1212	6	10			✓	
218W1A1213	9.5	9.5		✓		
218W1A1214	9	11			✓	
218W1A1215	9.5	9.5		✓		
218W1A1216	9	12			✓	
218W1A1217	8	11			✓	
218W1A1218	8.5	12			✓	
218W1A1219	10	11			✓	
218W1A1220	9.5	8	✓			
218W1A1222	6.5	9			✓	
218W1A1223	9	9		✓		
218W1A1224	7.5	8			✓	
218W1A1225	6	8			✓	
218W1A1226	6	6.5			✓	
218W1A1227	9	8.5	✓			
218W1A1228	8.5	9.5			✓	
218W1A1229	8.5	10			✓	
218W1A1230	4.5	3	✓			77.7%

218W1A1232	9	9		✓		
218W1A1233	8.5	11.5			✓	
218W1A1234	8.5	8	✓			
218W1A1236	9	11			✓	
218W1A1237	10	11.5			✓	
218W1A1238	9	10			✓	
218W1A1239	7.5	11			✓	
218W1A1240	8.5	11.5			✓	
218W1A1241	10	11.5			✓	
218W1A1242	9.5	10.5			✓	
218W1A1243	8	9			✓	
218W1A1244	4.5	7			✓	
218W1A1245	2.5	9.5			✓	
218W1A1246	8.5	10.5			✓	
218W1A1247	5	9			✓	
218W1A1248	7.5	9			✓	
218W1A1249	8	9			✓	
218W1A1250	7	7		✓		
218W1A1251	9.5	9.5		✓		
218W1A1252	9	9		✓		
218W1A1253	6.5	5	✓			
218W1A1254	8.5	11			✓	
218W1A1255	8	8.5			✓	
218W1A1256	7.5	9			✓	
218W1A1257	8.5	9.5			✓	
218W1A1259	9.5	9.5		✓		
218W1A1260	7.5	9.5			✓	
218W1A1261	7.5	7	✓			
218W1A1262	9.5	10.5			✓	
218W1A1263	9.5	10.5			✓	
218W1A1264	9	7	✓			
228W5A1201	7.5	7.5		✓		
228W5A1202	9	7.5	✓			
228W5A1203	7	9.5			✓	

228W5A1204	6	8			✓	
228W5A1205	9.5	12			✓	
228W5A1206	9.5	11			✓	
228W5A1207	9.5	11			✓	
228W5A1208	9	8	✓			
218W1A1265	6.5	8		✓		
218W1A1266	6.5	9	✓			
218W1A1267	5.5	12			✓	
218W1A1268	3.5	10			✓	
218W1A1269	5.5	5.5			✓	
218W1A1270	6.5	8.5			✓	
218W1A1271	8	9.5			✓	
218W1A1272	8	8		✓		
218W1A1273	A	6.5			✓	
218W1A1274	8	9			✓	
218W1A1275	9	7.5	✓			
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218W1A1277	6.5	9.5			✓	
218W1A1278	6.5	11.5			✓	
218W1A1280	7	10.5			✓	
218W1A1281	6.5	11.5			✓	
218W1A1282	7.5	9			✓	
218W1A1283	8	7.5	✓			
218W1A1284	5	9.5			✓	
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218W1A1291	6.5	9			✓	
218W1A1292	6	6.5			✓	
218W1A1293	3.5	5			✓	
218W1A1294	5.5	11			✓	
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218W1A1296	5.5	10			✓	
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218W1A12A0	6.5	10			✓	
218W1A12A1	6.5	4	✓			
218W1A12A2	8	6.5	✓			
218W1A12A3	4	11.5			✓	
218W1A12A4	2	11			✓	
218W1A12A5	6.5	7.5			✓	
218W1A12A6	8	12			✓	
218W1A12A7	6	10.5			✓	
218W1A12A9	6	9			✓	
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218W1A12B1	5.5	9.5			✓	
218W1A12B2	5.5	10			✓	
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218W1A12B9	6	5.5	✓			
218W1A12C0	5.5	8.5			✓	
218W1A12C2	4.5	7.5			✓	
218W1A12C3	1.5	11.5			✓	
218W1A12C4	9	10			✓	
218W1A12C5	6.5	9			✓	
218W1A12C6	4.5	12			✓	
218W1A12C7	6.5	9			✓	
218W1A12C8	7	9			✓	
228W5A1209	5	7			✓	
228W5A1210	6.5	9.5			✓	
228W5A1211	8	10			✓	

228W5A1212	6.5	7			✓	
228W5A1214	6.5	8			✓	
228W5A1215	6	11			✓	

Assessment of the effectiveness of the activity

No of students involved in activity	No of students with Negative change	No of students without change	No of students with Improvement	Impact (%)
130	**16**	**13**	**101**	**77.7%**

Students Performance	No of Students	Percentage
Improvement	78	57%
No Change	13	10%
Negative Change	16	12.3%