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TRAFFIC FLOW AT THE INTERSECTION OF AQUINO-INFANTE AVENUES AND GENERAL LUNA-M. H. DEL PILAR STREETS, ILOILO CITY

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Abstract: *The purpose of this study was to determine the present traffic flow, and the factors that cause traffic congestion in the intersection of Aquino-Infante Avenues and General Luna-M. H. del Pilar Streets in Iloilo City. The sample survey technique was used to gather primary data on the population, that is, the number of vehicles that were passing on the said intersection. The survey was conducted for one week. The method employed in conducting the survey was through traffic count using direct observation. Hand tally counters were used to count the distribution of traffic by time of day. Frequency counts, means and percentage were used in summarizing the data. Results of the study revealed that the peak hour of traffic in the intersection is in the late mornings and in the late afternoons, with General Luna Street as the busiest among the four road sections adjoining the intersection. Passenger cars, taxis and public utility jeepneys that are plying in the intersection had contributed much to the congestion of the intersection. This is evident by their high tally counts.*

▸. INTRODUCTION TO THE STUDY

With the rapid growth of population throughout the world, may people flock to the urban centers to scout for opportunities. This has resulted to a lot of urban problems. One such problem is the problem on traffic. It seems that urban development could not cope with the demand of the growing population. Traffic is not only the dilemma of the developed countries but even of third world countries as well. In the Philippines for example, traffic has already been considered as one of the serious and pressing problems.

Background of the Study

The problem on traffic is not only felt in Metro Manila but in other urban centers of the Philippines as well. Take the case of Iloilo City. Iloilo is one of the Philippines' growing cities. Being a bustling metropolis in Western Visayas, there are strong indications that traffic is becoming one of its major problems. Cocjin (2000) described the traffic situation in Iloilo City today as worse as compared in the past years.

Traffic congestion can be attributed to the disparity between road capacity and the increasing traffic volume in and around urban areas. Aside from the rising traffic volume, congestion due to accidents, roadwork for maintenance and repairs, and the aging of existing road facilities are also increasing (Maeda, 1991).

Coupled with problem on congestion, traffic may also pose a problem on safety. For the period of January 1998 to May 1998 alone, the Traffic Management and Engineering Unit (TMEU) of the Iloilo City Police Office has recorded a total of 1,845 vehicular related accidents, 14,682 driver's licenses confiscated due to various traffic violations, and 15 persons arrested for driving without a license.

Conscious of this growing problem, the researcher has attempted to study on the traffic problem of one of Iloilo City's road intersections, the intersection of Aquino-Infante Avenues and General Luna-M. H. del Pilar Streets. The intersection is said to be one of the busiest intersections in the city.

Aquino and Infante Avenues, General Luna and M. H. del Pilar Streets are four-lane streets that are adjoining the intersection. They are classified as national roads and its improvement, maintenance and repair are under the jurisdiction of the Department of Public Works and Highways, Region 6 with the coordination of the City Engineer's Office of Iloilo City. Traffic enforcement and security in the area is under the supervision of the Iloilo City Police Office (ICPO), specifically the Traffic Management and Engineering Unit (TMEU, 1998).

Aquino Avenue extends from the intersection of General Luna and M. H. del Pilar Streets and Infante Avenue and north bound terminating at Barangay Bolilao, Jaro with two tributary roads; one going to the Jaro Plaza and the other going to Ungka, Jaro. Infante Avenue extends from the intersection of General Luna and M. H. del Pilar Streets and Aquino Avenue and south bound terminating at Ledesma Street. General Luna Street extends from Iloilo Provincial Capitol in the city proper, west bound and terminating at the intersection of M. H. del Pilar Street and Aquino and Infante Avenues in Molo. Its opposite street is M. H. del Pilar. M. H. del Pilar Street

extends from the intersection of General Luna Street and Aquino and Infante Avenues and ends at the Molo Plaza.

Presently, the intersection is open to all types of vehicles at twenty-four hours a day.

Objectives of the Study

The objective of this study is to examine the present traffic flow in the intersection of Aquino-Infante Avenues and General Luna-M. H. del Pilar Streets.

More specifically, this study aims to: (a)find out the present traffic flow in the intersection; and (b) present factors that cause traffic congestion in the area.

Scope and Delimitation of the Study

This study is limited to determine the flow of traffic at the intersection of Aquino-Infante Avenues and General Luna-M. H. del Pilar Streets, Iloilo City.

This study does not attempt to present an analysis or absolute solution to problems of all road intersections. The researcher believes that road and traffic conditions vary too widely for every intersection that a "one-size-fits-all" solution is not justifiable.

Significance of the Study

The results of this study will benefit and trigger the realizations of the following: (a) the city traffic engineers, planners and policy makers can use these data as basis for developing proposals for Metro Iloilo so that traffic in the said intersection will not remain a problem but a factor of city's growth and development; (b) the results can also be used by real estate developers, consultants, and agents and homeowners associations for the purpose of appraising real estate properties within the vicinity of the intersection. Accessibility is the prime factor that increases the value of real estate property, however, traffic congestion may also be regarded as a negative factor; and (c) the results of this study may be also helpful to other researchers who are conducting traffic studies similar as this one.

Ultimately, the study may help address national and global issues such as: (a) the Filipino must be highly mobile— able to travel to any part of the country or the world using the road that is safe, convenient, reliable, fast, competitively priced according to the level of service, and environment-friendly; (b)local networks are linked to the national network and travel is facilitated by an all-weather network of roads, bridges, railways, sea and air lanes; and (c) goods and services are provided with a fully integrated, multi-modal transportation system that is safe, convenient, reliable and fast, competitively priced according to the level of service, and environment-friendly.

▸ REVIEW OF RELATED LITERATURE

Effects of Traffic on Mobility of People and Goods

Cocjin (2000) asserted that recently, the traffic situation in Iloilo City has deteriorated from bad to worse. The commuting public has to make a lot of adjustments of coping with clogged choke points while trying to catch up with office or class hours and appointments. He further stressed that gone are the days when one can breeze through from Jaro to Iloilo City and back in ten to fifteen minutes in a public utility jeepney. Furthermore, Cocjin contended that the emission from the exhausts of motor vehicles, whether moving or idling, is one big source of pollution of urban environment.

If one has to look at it deeply, traffic congestion is not just a recent problem. As early as Roman times, it was already a problem in the city life. Poor city planning, then as now, has been a basic cause, usually with roads planned in such a way as to bring traffic from all quarters converging to a main crossing point (Encyclopedia Britannica, 1994).

Maeda (1991) argued that congestion does not only impede the smooth flow of traffic and diminish the functionality of highways but also reduces driving safety and comfort. Inconvenience caused by traffic congestion often leads to frustrations among motorists and commuters or the riding public.

According to Murai (1991), at present, automobile plays the dominant transport role in most countries in the world. Due to this, traffic volumes continue to grow, traffic speeds continue to increase, and hindrances to traffic flows continue to have an effect over an ever-widening area. One of the consequences of this is that traffic congestion has become routine – the rule rather than the exception.

One element that is essential to man and will always be lost due to traffic congestion is time. Man when caught between traffic becomes unproductive. As shown in the recent AMI survey, in Metro Manila alone, over a million work hours are lost everyday due to traffic (Mendoza, 1999).

The National Economic and Development Authority (NEDA) forecasted that road traffic in the Philippines will grow quickly, projecting that from

1995-2004, there will be 50% traffic growth for the interurban areas, and 100% for the surrounding urban areas. In 10 years time, traffic demand is expected to double. If no effective action is taken to counter this problem, not only will traffic impend the movement of people or goods, but likewise, be a serious constraint to future economic performance of the country.

Traffic Management and Control Techniques

To relieve the heavily populated urban areas with vehicular congestion and air pollution, and to improve mobility and safety of motorists and pedestrians, many cities employ effective traffic engineering, usually involving prescribed traffic rules and regulations, and employing traffic devices such as signals, signs and markings. In smaller cities, with lighter traffic, comparable engineering techniques and simpler control devices are used (Beimborn, 1993).

In most localities, traffic control management was established for the safe and efficient flow of automobiles, buses, and trucks over city streets and highways. The ways of promoting this varies from simple improvement on local streets by installing traffic signs and pavement markings to a more sophisticated construction of a comprehensive freeway control systems. These comprehensive systems include the use of ramp meters to monitor and control freeway access; closed-circuit television surveillance cameras are installed at strategic locations along roads or highways to detect quickly any deteriorating traffic flow; and stand-by emergency services are available to provide aid in case of accident and injury (Beimborn, 1993).

The use of one-way streets, enforcement of traffic flow regulations, building traffic islands and turning bays, and the use of traffic signals are some other traffic-control techniques being considered and implemented in many areas (Beimborn, 1993).

In Iloilo City as in many cities of the world, at busy city street junctions, traffic light signals were installed to permit safe movement of vehicles and pedestrians. According to Beimborn (1993), in this system, the most widely used of traffic signalization was the fixed-time system. The length of the green light is the same for the whole time and is set to favor traffic on the main roadway. Main roadway traffic is halted intermittently to allow the side-street traffic to cross the intersection for a short fixed time before the signal again allows traffic on the main roadway. The time element in the cycle of signal changes is determined by systematic studies of traffic flow and pedestrian needs. Such cycle lengths can be fixed to vary during the day to serve changing traffic patterns.

As of now, one way of decongesting traffic in the city streets of Iloilo is to build and construct new roads, or to widen the existing ones. But according to Cocjin (2000), despite of the additional roads constructed, it appears that the volume of vehicles on the roads of the city still manages to congest choke points especially in the main arteries.

▸ RESEARCH DESIGN AND METHODOLOGY

Research Design

In this study, the sample survey technique design was used to gather primary data on the population, that is, the number of vehicles that are passing on the said intersection per day. The method employed in conducting the survey was through traffic count using direct observation. The observation approach was non-participant (NPO).

The data gathering were done using the hand tally counters or mechanical counters that record the distribution of traffic by time of day, in one week. The data were summarized to show the Average Daily Traffic (ADT) and average weekday characteristics by traffic station.

Development of the Survey Instruments

The observation guide or survey instruments includes the following aspects: (a) frequency of vehicles passing in the observed direction at a specified time; and (b)types of vehicles passing in the observed direction at a specified time.

Data Gathering and Fieldwork

The fieldwork for this project was conducted for one week, from six o'clock in the morning up to eight o'clock in the evening, and a random traffic count survey between eight o'clock in the evening and five o'clock in the morning. At a designated point at each road section, the vehicles were counted as they inbound the road section. The types of vehicles and the road section where they came from were also recorded. An interval of thirty (30) minutes was allotted for the counting of vehicles passing at the road section coming from the opposite side, from the right side and from the left side.

▸ FINDINGS

The following are the results of the study:

1. The average daily traffic (ADT) volume passing at the road sections of the intersection is 97,906. When the entire traffic count was ranked according to road sections, General

Luna Street ranked number one with 31,677 (32.35%), followed by Aquino Avenue with 26,138 (26.70%), then by M. H. del Pilar Street with 23,860 (24.37%), and lastly by Infante Avenue with 16,231 (16.58%). Table 1 shows the summary of the results of the finding.

In this finding, it should be noted that a vehicle can be counted twice since it will be counted first in the inbound lane of one road section as it enters the intersection, and then in the outbound lane of another road section as it leaves the intersection.

Table 1. Average Daily Traffic Volume When Ranked According to the Road Sections Whose Traffic is Flowing in Both Directions, Inbound And Outbound

Road Section	M	Rank	%
A. Average Daily Traffic	97,906		100.00
B. General Luna Street	31,677	1	32.35
C. Aquino Avenue	26,138	2	26.70
D. M. H del Pilar Street	23,860	3	24.37
E. Infante Avenue	16,231	4	16.58

There is no restriction as to the direction of flow of traffic at the intersection. Figure 1 shows that at green light, the vehicles at the inbound lanes of the four road sections can cross at the intersection going to any of the three outbound lanes as shown by the arrows.

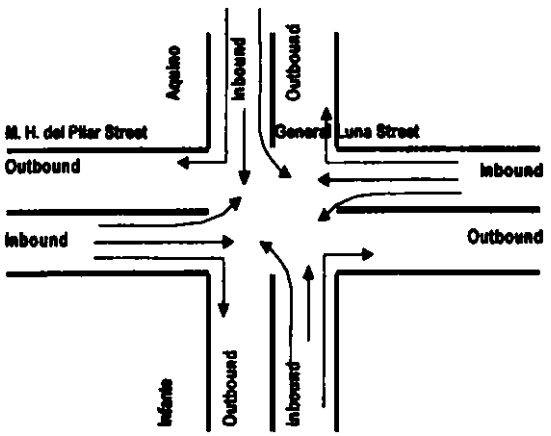

Figure 1. Traffic Flow Direction at the Intersection.

When the inbound and outbound flow of traffic at the various road sections of the intersection were calculated and determined, and the average daily volume of the traffic in both directions were recorded separately, so that the predominate direction and the opposite direction of traffic flow per road section are identified, the result showed that for General Luna Street, the outbound lanes are predominate with 16,034 (50.62%), and the inbound lanes as opposite with 15,643 (49.38%). For Aquino Avenue, the inbound lanes are the predominate with 13,868 (53.05%), and the outbound lanes as opposite with 12,271 (46.95%). For M. H. del Pilar Street, the outbound lanes are predominate with 12,749 (53.43%), and the inbound lanes as the opposite with 11,111 (46.57%). Lastly, for Infante Avenue, the inbound lanes are predominate with 8,333 (51.34%), and the outbound lanes as the opposite with 7,899 (48.66%).

In Table 2, the summary of the data is shown when traffic count is classified according to the direction of flow relative to the intersection.

Table 2 *Average Frequency of Daily Traffic Volume at the Road Sections of the Intersection when Traffic Count is Classified According to the Direction of Flow*

Road Section	Ave. f	%	Description
A. Average Daily Traffic	97,906		
B. General Luna Street			
Inbound	15,643	49.38	Opposite
Outbound	16,034	50.62	Predominate
C. Aquino Avenue			
Inbound	13,868	53.05	Predominate
Outbound	12,271	47.95	Opposite
D. M. H del Pilar Street			
Inbound	11,111	46.57	Opposite
Outbound	12,749	53.43	Predominate
E. Infante Avenue			
Inbound	8,333	51.34	Predominate
Outbound	7,899	48.66	Opposite

Figure 2. Shows the direction of the predominate flow of traffic at the various road sections of the intersection. The figure indicates that the inbound lanes of both Aquino Avenue and Infante Avenue which are opposite road sections of the intersection are the predominate, while M. H. del Pilar Street and General Luna Street which are also road sections opposite each other, the predominate flow is at the outbound side.

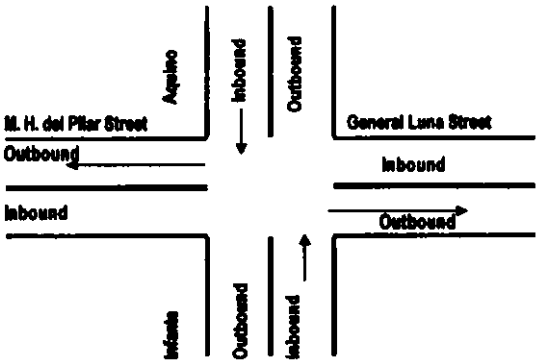

Figure 2 Predominate Traffic Flow at the Road Sections of the Intersection.

When the average daily traffic count based on the incoming vehicles towards the intersection or in the inbound side of the road sections were compared, the result showed that those vehicles coming from General Luna Street is the heaviest with an average volume of 15,643 (31.95%) per day, followed by Aquino Avenue with 13,868 (28.33%), then by M. H. del Pilar Street with 11,111 (22.70%), and lastly by Infante Avenue with 8,333 (17.02%). Table 3 summarizes the data.

Table 3 Average Daily Traffic Count Based on the Inbound Lanes of the Road Sections or Average Number of Vehicles Entering the Intersection

/Road Section	M	Rank	%
A. Total Average Daily Traffic at the Inbound Side	48,953		100.00
B. General Luna Street	15,643	1	31.95
C. Aquino Avenue	13,868	2	28.33
D. M. H del Pilar Street	11,111	3	22.70
E. Infante Avenue	8,333	4	17.02

When the average daily traffic count based on the outgoing vehicles, or those leaving from the intersection were compared, the result showed that those vehicles entering General Luna Street is the heaviest with an average volume of 16,034 (32.75%) per day, followed by M. H. del Pilar Street with 12,749 (26.04%), then by Aquino Avenue with 12,271 (25.07%), and lastly by Infante Avenue with 7,899 (16.14%). See Table 4.

Table 4 Average Daily Traffic Count Based on the Outbound Lanes of the Road Sections or Average Number of Vehicles Leaving the Road Intersection

Road Section	M	Rank	%
A. Total Average Daily Traffic at the Outbound Side	48,953	100.00	
B. General Luna Street	16,034	1	32.75
C. M. H del Pilar Street	12,749	2	26.04
D. Aquino Avenue	12,271	3	25.07
E. Infante Avenue	7,899	4	16.14

2. The traffic count showed that when the peak hour is determined to find the maximum average traffic volume at the road sections, General Luna Street is heaviest at 4:30-5:30 PM with 2,570 vehicles/hr, followed by Aquino Avenue which is heavy traffic at 10:30-11:30 AM with 2,183 vehicles/hr, then by M. H. del Pilar Street which is heavy traffic at 5:00-6:00 PM with 1,940 vehicles/hr, and finally by Infante Avenue which is heavy traffic at 10:30-11:30 AM with 1,398 vehicles/hr. Table 5 summarizes the result of the finding. Aquino and Infante Avenues are heavy traffic in the late morning while General Luna and M. H. del Pilar Street is heavy in the late afternoon.

Table 5 Peak Hour of the Volume of Traffic at the Road Sections of the Intersection

ROAD SECTION	PEAK HOUR	TRAFFIC VOLUME	RANK
GEN. LUNA	4:30-5:30 P.M.	2,570	1
AQUINO	10:30-11:30 A.M.	2,183	2
MH DEL PILAR	5:00-6:00 P.M.	1,940	3
INFANTE	10:30-11:30 A.M.	1,398	4

Further, when each road section is divided into lanes of predominate and opposite directions, the volume of vehicles at the predominate direction at peak hour for the morning and afternoon traffic for Aquino Avenue is 1,204 (10:30-11:30 AM; inbound)and 1,126 (4:30-5:30 PM; outbound), for Infante Avenue is 702 (10:30-11:30 AM, outbound) and 682 (4:30-5:30 PM; inbound), for General Luna Street is 1,350 (10:00-11:00 AM; outbound) and 1,386 (4:30-5:30 PM; inbound), and for M. H. del Pilar Street is 950 (10:30-11:30 AM; outbound)and 1,147 (5:00-6:00 PM; outbound).

Based from the data in Table 6, it should be noted that the mode of the peak hours at the road sections of the intersection is 10:30-11:30 in the morning and 4:30-5:30 in the afternoon.

Table 6 Volume of Traffic at Peak Hour at the Road Sections When Classified According to Predominate or Opposite Direction

ROAD SECTION	PEAK HOUR	TRAFFIC VOLUME	PREDOMINATE DIRECTION		OPPOSITE DIRECTION	
			Inbound	Out bound	Inbound	Out bound
AQUINO						
AM	10:30-11:30	2,183	1,204			979
PM	4:30-5:30	2,171		1,126	1,045	
INFANTE						
AM	10:30-11:30	1,398		702	696	
PM	4:30-:30	1,216	682			534
GEN. LUNA						
AM	10:00-11:00	2,473		1,350	1,124	
PM	4:30-5:30	2,570	1,386			1,184
MH DEL PILAR						
AM	10:30-11:30	1,853		950	903	
PM	5:00-6:00	1,940		1,147	793	

Table 7 shows the volume of the flow of traffic at peak hour from the source road section going to the destined road section as they pass the intersection. There are three destined directions. The direction of the traffic flow was classified as through or going to the opposite side, turning to the right or turning to the left. The volume of traffic at the peak hours for the morning and the afternoon were recorded in the table. The finding showed that for Aquino Avenue, most vehicles are coming from Infante Avenue (441) in the morning followed by General Luna Street (413), and in the afternoon from General Luna Street (600) followed by Infante Avenue (421). Less number of vehicles is coming from M. H. del Pilar Street (159, AM; 151, PM). For Infante Avenue, most vehicles entering the road section are coming Aquino Avenue (556, AM; 467, PM), followed by those coming from General Luna (83, AM; 83, PM) and lastly from M. H. del Pilar Street (70,AM; 66, PM). For General Luna Street, most vehicles entering the road sections are coming from M. H. del Pilar Street (741, AM; 644, PM), followed by those from Aquino Avenue (471, AM; 417 PM) and lastly from Infante Avenue (187, AM;182, PM). For M. H. del Pilar Street, most vehicles are coming from General Luna Street (707, AM; 797, PM), followed by those coming from Aquino Avenue (186, AM; 218, PM), and lastly from Infante Avenue (128, AM; 135, PM). The pattern of the flow of traffic for both morning and afternoon is similar to all road sections except for Aquino Avenue.

Table 7 Peak Hour Volume per Lane, the Flow of Traffic Being Towards the Road Section Leaving the Intersection

DIRECTION	PEAK HOUR		TRAFFIC VOLUME					
			THROUGH		LEFT TURN		RIGHT TURN	
FROM TO	AM	PM	AM	PM	AM	PM	AM	PM
AQUINO								
	11:00-12:00	5:00-6:00	441	421				
	11:00-12:00	4:00-5:00					413	600
	11:00-12:00	5:00-6:00			159	151		
INFANTE								
	10:30-11:30	3:30-4:30	556	467				
	9:00-10:00	3:30-4:30					70	66
	11:00-12:00	2:30-3:30			83	83		
GEN. LUNA								
	7:30-8:30	3:30-4:30	741	644				
	10:00-11:00	3:00-4:00					187	182
	10:30-11:30	2:30-3:30			471	417		
MH DEL PILAR								
	7:30-8:30	5:00-6:00	707	797				
	7:30-8:30	4:30-5:30					186	218
	11:00-12:00	5:00-6:00			128	135		

3. When the average daily traffic passing at the intersection were classified according to type of vehicles, the passenger cars and taxis lead the rest of the vehicles with 19,709 (40.26%). This was followed by the Public Utility Jeepneys (PUJ) with 19,534 (39.90%), then by other types of vehicles which were grouped into one with 4,820 (9.85%), then by the light cargo vehicles (LCV) with 3,001 (6.13%), then by heavy cargo vehicles (HCV) with 1,114 (2.28%), and lastly by the public utility buses (PUB) with 776 (1.59%). See Table 8 for the summary of data.

Table 8 Average Daily Traffic Volume Classified According to Types of Vehicles Passing at the Inbound Lanes of the Road Sections

Vehicle Type	M	Rank	%
A. Average Daily Traffic at the Inbound Lanes of the Road Sections	48,953		100.00
B. Car/Taxi (C/T)	19,709	1	40.26
C. Public Utility Jeepney (PUJ)	19,534	2	39.90
D. Others (Pedicab, Motorcycle, etc.)	4,820	3	9.85
E. Light Cargo Vehicle (LCV)	3,001	4	6.13
F. Heavy Cargo Vehicle (HCV)	1,114	5	2.28
G. Public Utility Bus (PUB)	776	6	1.59

▸ CONCLUSIONS AND RECOMMENDATIONS

Conclusions

In view of the above findings, the following conclusions were drawn upon:

1. The heavy volume of traffic that passes General Luna Street maybe attributed to the fact that the road section is more convenient for travel between the city proper at one end of the road and the district of Molo on the other. The concentration of city activities, both business and commerce lies within the city proper area which is being served by the said road section. This includes commercial establishments, business offices, government offices, and educational institutions. The Molo end of the road on the other hand is the point of convergence of people coming from all parts of the southern and central parts of the city and province of Iloilo. The road section is maybe a

convenient thoroughfare for these commuters in going to the city proper for their intended business transactions and upon returning home. The other road sections of the intersection are also becoming congested especially the Aquino Avenue because of perhaps similar reasons.

The intersection has also become a busy one considering perhaps of the rapid growth and development in the surrounding area for the past years.

2. The peak hour of traffic in the intersection is usually in the late morning and in the late afternoon. The late morning congestion maybe attributed to the reason that the activities within the city proper area are starting in the late morning considering that most commercial and business establishments open their business at 9:00 o'clock in the morning. The afternoon rush in the intersection maybe attributed to the end of ones work or classes for most people and are now moving out the city proper area for home or for leisure.

3. Passenger cars and taxis followed closely by the public utility jeepneys are dominating the types of vehicles that are passing in the said intersection. Maybe, this is due to the fact that the road sections adjoining the intersection are the most convenient routes for commuters, both the well to do and the ordinary people, in going to their place of work or business and in going back to their respective homes.

Recommendations

To further improve the traffic flow at the road intersection, the following recommendations or schemes are suggested:

Scheme 1— In this scheme, no suitable junction improvement or major infrastructure project is recommended, just an efficient traffic management. Aquino Avenue and Infante Avenue are constructed of four-lane carriageways and cross General Luna Street and M. H. del Pilar Street at right angle. The area's right of way is too small for the construction of a fly-over at this junction to provide more safety for the four-way intersection. Extending the right of way maybe costly considering the value of property that surrounds the vicinity of the intersection. Instead, more efficient traffic light signalization is proposed, giving more green lights to the main roadway or to the heavy traffic road section, that is, General Luna Street.

Road signs, hazard markings and give way signs must be properly maintained along the approaches of the intersection. In addition, drainage system in the junction must be properly maintained and if necessary improved, especially in the Infante Avenue area where elevation is lower as compared to other areas of the intersection. The flooding in the area due to the accumulation of water even in short rainfall tends to retard the velocity of vehicles passing in that part of the intersection.

Traffic policemen must also be permanently assigned to the area round the clock, to keep the flow of traffic in order especially during brown-outs wherein signal lights are not functional and during rush hours wherein many motorists would like to beat the red light. Figure 3 shows the present flow of traffic in the intersection.

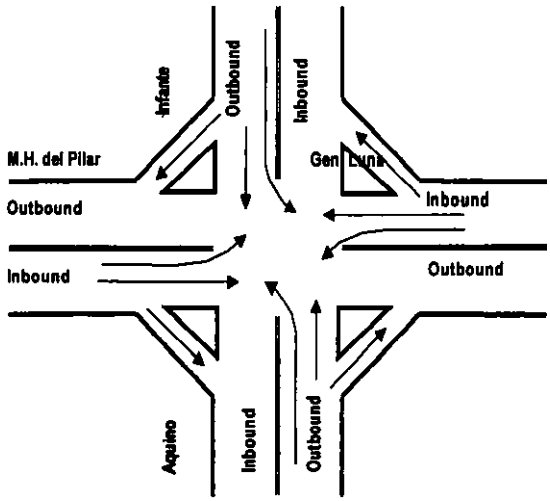

Figure 3. Traffic Flow at the Intersection Using the Present Traffic System.

Scheme 2 — A more modest roundabout or rotunda can be constructed in the intersection in replacement to traffic lights signalization. Again, due to the limitation of the right of way of the intersection, the diameter of the rotunda may be limited to 6 meters only, just enough for the motorists or drivers to make a good maneuver in crossing the intersection.

Unlike in the traffic lights signalization, wherein the flow of traffic in one direction is temporarily interrupted at timed intervals to give way to the vehicles of the adjacent road sections to cross, the vehicles can manage to maneuver and pass at the intersection going to their desired destination anytime without much interruption. The proposed roundabout or rotunda is found in Figure 4.

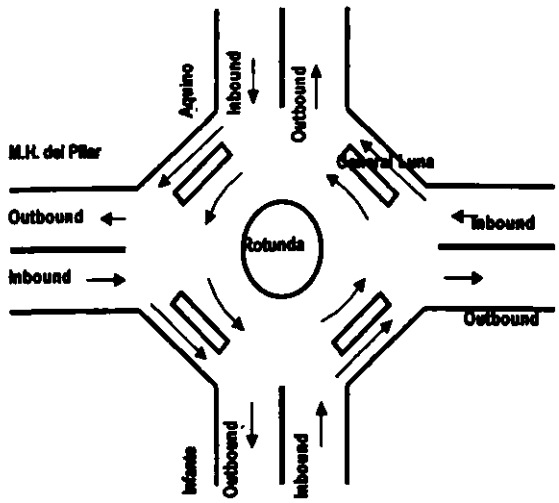

Figure 4. Traffic Flow at the Intersection When Rotunda or Roundabout is Implemented.

Scheme 3 — To keep the road intersection efficient, it is proposed that some public utility transportation passing in the said intersection be re-routed say the public utilities plying the provincial routes. It should be noted that 41.49% of the vehicles passing in the intersection are public utility jeepneys and buses.

However, further study should be conducted whether or not re-routing of some public utility vehicles in the area is possible in order to decongest the road section, since this scheme if implemented may cause an effect to the economy and the mobility of people and goods of the surrounding area.

Lastly, whichever scheme is to be adopted and implemented in improving the traffic management in the intersection, now depends on the decision of the proper government agencies.

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AVERAGE VOLUME OF TRAFFIC COUNTED AS PER LANE, IN BOTH INBOUND AND OUTBOUND DIRECTION
INTERSECTION GEN. LUNA-M. H. DEL PILAR AND AQUINO-INFANTE STREETS

ROAD SECTION: GENERAL LUNA STREET
DATE: 02 FEBRUARY - 08 FEBRUARY 2000

DIRECTION OF TRAFFIC	FROM	AVERAGE VOLUME OF TRAFFIC PER DAY								TR VOL/ SECTION
		INFANTE	DEL PILAR	AQUINO	TR VOL/	GENERAL LUNA STREET			TR VOL/	
	TO	GENERAL LUNA STREET			DIR	INFANTE	DEL PILAR	AQUINO	DIR	
	TIME:									
AM										
12:00-5:00	5 HR	19	88	54	160	11	115	72	198	358
5:00-6:00	30 MIN	5	17	10	32	3	12	14	28	60
	30 MIN	10	54	33	96	6	80	44	130	226
6:00-7:00	30 MIN	19	168	112	299	11	177	117	305	604
	30 MIN	50	271	159	479	12	208	152	372	851
7:00-8:00	30 MIN	67	338	196	601	13	321	169	504	1104
	30 MIN	69	374	221	664	21	349	164	534	1198
8:00-9:00	30 MIN	69	367	223	659	26	358	167	551	1210
	30 MIN	76	349	214	639	25	348	167	540	1179
9:00-10:00	30 MIN	78	336	211	626	23	313	184	519	1145
	30 MIN	90	340	223	654	28	309	194	531	1185
10:00-11:00	30 MIN	93	346	231	670	28	321	202	551	1221
	30 MIN	94	351	234	679	39	333	200	573	1252
11:00-12:00	30 MIN	68	327	236	632	41	318	208	567	1199
	30 MIN	70	286	198	555	42	311	205	558	1113
PM										
12:00-1:00	30 MIN	79	232	153	465	27	302	183	512	977
	30 MIN	74	264	172	510	33	304	169	506	1016
1:00-2:00	30 MIN	79	297	194	570	35	306	199	539	1110
	30 MIN	81	302	190	573	32	309	219	560	1133
2:00-3:00	30 MIN	87	317	191	594	32	311	214	557	1151
	30 MIN	90	309	209	607	38	313	210	561	1168
3:00-4:00	30 MIN	91	306	208	605	45	308	261	613	1218
	30 MIN	91	322	207	620	35	305	273	612	1233
4:00-5:00	30 MIN	76	321	201	599	32	326	296	654	1253
	30 MIN	81	312	200	592	30	349	304	684	1275
5:00-6:00	30 MIN	80	307	205	592	26	396	282	703	1295
	30 MIN	71	279	174	524	25	401	249	676	1200
6:00-7:00	30 MIN	62	243	140	445	27	356	198	582	1027
	30 MIN	60	238	138	436	21	312	168	501	937
7:00-8:00	30 MIN	44	176	74	294	15	200	104	319	613
	30 MIN	27	70	37	134	6	78	58	143	277
8:00-12:00	4 HR	71	246	111	428	21	278	162	462	890
TOTAL		2121	8553	5360	16034	809	9029	5805	15643	31677

CONDUCTED BY: **SUPERVISED BY:**

AVERAGE VOLUME OF VEHICLES CLASIFIED PER TYPE PASSING AT THE ROAD SECTION OF THE INTERSECTION
INTERSECTION GEN. LUNA-M. H. DEL PILAR AND AQUINO-INFANTE STREETS

ROAD SECTION: GENERAL LUNA STREET
DATE: 02 FEBRUARY - 08 FEBRUARY 2000

		TYPE OF VEHICLE						TR VOL/ SECTION
		C/T	PUJ	PUB	LCV	HCV	OTH	
TIME:								
AM								
12:00-5:00	5 HR	142	153	0	19	3	39	358
5:00-6:00	30 MIN	25	25	0	3	1	7	60
	30 MIN	89	98	0	12	2	25	226
6:00-7:00	30 MIN	237	262	1	34	6	65	604
	30 MIN	330	376	1	47	8	89	851
7:00-8:00	30 MIN	422	497	1	59	11	115	1104
	30 MIN	456	541	1	64	11	125	1198
8:00-9:00	30 MIN	463	543	1	65	12	127	1210
	30 MIN	453	528	1	63	11	124	1179
9:00-10:00	30 MIN	444	507	1	62	11	120	1145
	30 MIN	463	519	1	65	12	125	1185
10:00-11:00	30 MIN	478	535	1	67	12	129	1221
	30 MIN	492	545	1	68	12	133	1252
11:00-12:00	30 MIN	475	514	1	67	12	129	1199
	30 MIN	445	473	1	62	11	121	1113
PM								
12:00-1:00	30 MIN	387	420	1	52	9	106	977
	30 MIN	400	441	1	55	10	109	1016
1:00-2:00	30 MIN	439	478	1	61	11	119	1110
	30 MIN	450	487	1	62	11	122	1133
2:00-3:00	30 MIN	455	498	1	62	11	123	1151
	30 MIN	464	501	1	64	12	125	1168
3:00-4:00	30 MIN	494	509	1	68	12	133	1218
	30 MIN	497	519	1	69	12	134	1233
4:00-5:00	30 MIN	506	525	1	70	12	137	1253
	30 MIN	516	535	1	71	13	140	1275
5:00-6:00	30 MIN	516	552	1	71	13	141	1295
	30 MIN	475	515	1	65	12	131	1200
6:00-7:00	30 MIN	405	444	1	54	10	113	1027
	30 MIN	366	411	1	49	9	101	937
7:00-8:00	30 MIN	237	273	1	31	5	66	613
	30 MIN	110	119	0	15	3	30	277
8:00-12:00	4 HR	347	392	1	46	8	96	890
TOTAL		12477	13736	36	1723	308	3398	31677

CONDUCTED BY: _____

SUPERVISED BY: _____

TEAM COACHING AND TEAM BUILDING IN CE EDUCATION *

WALDEN S. RIO

Abstract: *Today's typical graduate of Engineering schools in the Philippines lack what is known as soft skills. A thorough, working knowledge of soft skills is a vital importance to the graduate Engineer because he has to deal with people in the workplace. Although two of these - - communication and leadership skills - - are included in classroom discussions, others of equal importance, such as team coaching and team building are hardly discussed. To answer this need, the subject Social Science 20 – Human Resource Development, was offered in the College of Engineering. The subject matter includes self-development planning, team coaching and team building. In the area of team building the following are the topics covered. Time management, stress management and conflict resolution. In addition to the soft skills the student learns, he is also taught how to prepare a self-development plan. Hopefully, this will teach our graduates how to plan for their future. The offering of Soc Sci 20 in the CPU College of Engineering will equip Engineers with vital skills which will be an asset to them when working with industry.*

▸ INTRODUCTION

There is today a growing trend for engineering graduates not only to possess knowledge and skills in the technical aspects but also additional skills when they work with industry. It is, however, important to differentiate between knowledge and skill. Knowledge is defined as "acceptance with facts, truths, or principles, as from study or investigation; the fact or state of knowing; clear and certain mental apprehension;" while skill is a "developed proficiency or dexterity in some art, craft, or the like; deftness in execution or performance; a trade or craft requiring special training for competence or expertness in its practice." In other words, knowledge is "understanding what," while skill is "understanding how". When a curriculum describes a course objective with a noun it indicates the knowledge a student is supposed to learn. If, however, it is a noun what the student will learn is skill.

Why are these skills needed? Several reports and papers indicate that there is a pressing need for graduates to possess these additional skills now.[1] Another very important reason for having these additional skills is the requirements of the new ABET EC 2000 curriculum found in criterion 3. The following are the additional skills needed by graduates per criterion 3.[2]

3d "an ability to function in multidisciplinary teams"

3f "an understanding of professional and ethical responsibility"

3g "an ability to communicate"

3n "the broad education necessary to understand the impact of engineering solutions in a global/societal context"

3i "a recommendation of the need for an ability to engage in lifelong learning"

3j "a knowledge of contemporary issues"

What are these additional skills.[3-6] Several terms are associated with these skills among which these are organizational skills, soft skills, soft criteria and performance skills. These skills are classified into the following: major concentration management skills, communication skills, interpersonal skills, leadership skills and decision-making skills. The major concentration is management skills divided into sub areas of concentration. Some of the major concentration skills are partly covered in a typical engineering curriculum; among these are management skills and communication skills. The other's are, however, seldom taken or covered in the engineering curriculum.

There are three important skills which are requisite for graduates of engineering schools. These are teamwork skills, communication skills, and leadership skills. Why are these three soft skills needed? The answer why these skills are needed is because they have been identified by both academe and industry as necessary for graduates when they work with industry.[7]

▸ INTRODUCING SOFT SKILLS IN ENGINEERING EDUCATION

The College of Engineering of Central Philippine University was convinced that it was necessary to equip engineering graduates with these soft skills. It was decided that soft skills would be included in the present curriculum. The number of subjects needed in teaching soft skills was, however, limited to only one because the present engineering curriculum is already overloaded, making it

* *Presented at the National Congress on Civil Engineering Education De La Salle University 2000*

impossible to add more than one subject.

To make sure that all engineering graduates acquire some of the necessary soft skills, the subject known as Soc Sci 20 – Human Resource Development, was made a required subject for all courses in the College of Engineering.

Soc Sci 20 consists of three major sections and was a 3-unit course. The first major area of the subject is preparing a self-development plan. Although this is not one of the major soft skills required, it was felt that the offering of this subject matter was important since a majority of graduate engineers at present do not have a self-development plan of their own. In the US the percentage of people without a self-development plan is around 85%. It is safe to presume that a much higher percentage prevails in the Philippines. Without a self-development plan engineers would never be able to easily plot their future. A very important skill involved in this subject area is communication skill. This is because students are required to prepare a self-development report of their future.

The second area covered by the subject is the concept of team coaching. This area seeks to teach students how to deal with different types of people they will work with when they have graduated and started to work with industry.

The third subject area covered in the course is team building. This area seeks to teach and impart to engineering students interpersonal skills they will need. Among these are stress management, time management, and conflict management skills.

▸ SELF-DEVELOPMENT PLAN

This subject uses the reference on motivating and goal-setting.[1] This area of the subject explains the importance of preparing a self-development plan. The areas involved in preparing a self-development plan are the following: identity, values, goals, action plan, motivation, discipline, flexibility and outcome. Identification of one's self is important and the best person to do this is the one who is preparing the self-development plan. Of utmost importance is defining one's identity as plan. The student will be able to identify what his strengths and weaknesses are and how he performs his job and gets along with people.

For the next step, the student determines what his/her values are. Different terms are used to identify values and among these are principles, purpose, convictions, ideals and beliefs. Establishing values allows the student to set goals according to his priority. Without knowing the values, a student will hardly be able to set the right priority.

The next area is setting goals. There are several reasons are given why any individuals cannot always achieve the goals he has set. Among the reasons are it entails hard work, the fear of failure or fear may grip individual. What results when a student defines his/her goals are based on his values. He should set specific goals and then write them down. Another very important factor is to consider is that goals should be attainable. It should be mentioned that when goals are achieved rewards will be given. Thinking about goals is necessary if the student wants to be successful; however to be successful an action plan has to be undertaken.

The preparation of the action plan is important and since goals are only dreams, an action plan has to be prepared to make it a reality. The action plan will always be based on the goals that have been set. The process of creating an action plan starts by identifying the top priority goals and these should be clear, concise and achievable. In the next column identify the activities needed to achieve the goal. When all these are done for all the goals that have been set, determine the resources needed for each activity listed. The last column will be the time frame necessary to accomplish the goals. The action plan may be successful so use motivation to achieve the successful implementation of the goals.

To motivate oneself to achieve the desired goals it is important to state an assumption: "People don't behave in a particular way without an incentive." There are several ways to motivate yourself. The first method that can be used is fulfilling a personal emotional need you desire. The important factors you can use are defined by the following criteria: The first is believe in yourself; this is followed by overcome your fears; and third is start as soon as possible; and finally, focus on your rewards. When you have established motivation in your action plan the next step is to discipline yourself to do the work needed to achieve the goal. This can be done in three steps: take responsibility of your self, do not wait but start at once and finally, practice good habits.

The goals that you set may not always be achieved so be flexible. You should not be afraid to change. There are different types of change it may be subtle or it may be drastic. It may however be advantageous to you if you know how to adapt to it. If you do, the key to change is to be flexible when necessary.

The last step is the outcome or results of your goals. It is important to explain that goals are merely

conceptual while the outcome is reality. When you evaluate the outcome remember to hold it in high regard, take pride in your success. Focus on what you did right and find out what we went wrong when you did not achieve your goal. When all of these are done it is time to set your next goal.

▸ TEAM COACHING

This area of the subject matter is important because it is a very efficient method for leadership training. Two important advantages of team coaching are it is a beneficial process or a win-win process; and it is forward-looking and helps a team win.[9]

It is, however, very important that a coach should learn five insights of people . These are people tend to act out the way they look at life; individual uniqueness should be valued and explored, motivation is usually related to discouragement and not any other problem; the best way to understand performance is to identify the consequence of an individual's action and lastly, people who are responsible for their actions tend to take responsibilities seriously. The process a coach should undertake uses a five-step method as is shown in Fig. 1.

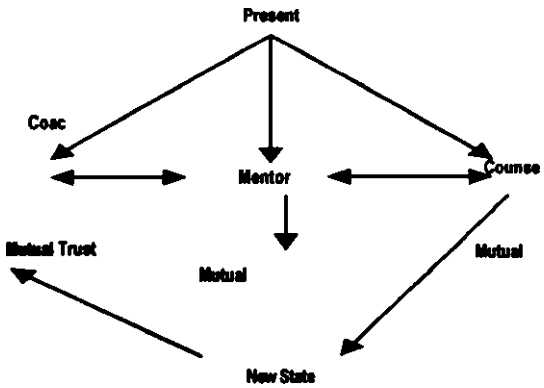

Figure I Five Steps Coachig Method

The process of learning starts with your present state which defines what you know about leadership. In order to learn leadership, the first step you must take is to be a coach and being able to share ideas with your team. This means that team members under this category understand how to do the job and mutual trust prevails. This can be done by inspiring, clarifying, probing, acknowledging and challenging. What you do is just coach your team and not mentor or counsel them.

The second step is you become a mentor, which means your team member does not know how to do the job and has to be taught. This can be done by teaching, instructing, leading and guiding people. In order to make mentoring of people successful, mutual commitment to do the job is important.

The third step is when you have members of the team who do not want to do the job nor care to learn. It means you have to counsel these team members. The steps use are as follows: Agree that there is a problem and discuss the alternative solution. Next, agree on an action plan. This is followed by identifying the consequence and follow-up of what is to be done. When the work is done measure the progress made and record only your achievement. It is important that mutual respect between you, the coach, and your team members should exist, and be sure to reward your people involved when the goal is achieved.

The final step is known as a new state of existence and if you are a good coach you will a team which will now be efficient. There is mutual benefit to the whole team and your team will continue to learn. To further succeed as a team you must always identify your vision and explain how to reach it. The procedure is similar to the self- development plan discussed in the first part. After all of this is done, you have learned leadership skills and you are now a coach and a leader.

▸ TEAM BUILDING

There are four skills that should be taught in the area of team building. The area of motivating skills is already taught in both the first section of preparing a self-development plan and in the second section of team coaching. There is only therefore three team skills which are taught in this section.

The first skill taught is time management[10]. This skill seeks to answer the problem of seemingly having no time to get all the work done. The first step is to find out why things cannot be done. One important aspect that should be considered is the preparation necessary to get a job done. The next step is to act goals and priorities to be done. When the priorities have been set a plan of action is prepared and implemented. When time management is implemented in the office or your work identify typical time wasters. As much as possible these should either be eliminated or minimized. Steps to organize your work are then identified (including existing problems) and as soon as this is done you are able to control your work and subsequently your time. The ability to get things done when working with others is also explained. It is important to take control of your time especially when you meeting a deadline. A section on taking control of your mind is taught with problems of not being able to get things done. In doing this you will be able to do your work within the time

allocated to you.

The next skill that is taught is stress management[11]. Part of this topic is taught when as a coach you have to counsel how to deal with your team members who will be cause of conflict if not properly handled. The types of stress are identified as well as the three ways of responding to each type are explained. The three types of stress are the good, bad and ugly and how it affects you. The next lesson that is taught are priorities and expectations and how to cope with change. It is very important that you can confront and accept change. This will minimize its bad effects on your health.

The importance of communication in stress management is also included. The problem of stress present may only be due to communication problems. When you are able to develop good communication skills with yourself and with others you will be able to minimize if not entirely eliminate the stress. The ten techniques to manage stress is then taught. This will help you in combating stress and its unpleasant effects. You will also find out if you are stressed in your work. The three ways you can reduce negative effects of stress are diet, relaxation techniques and exercise. However, it is important that the three ways of combating stress should be done with cautions care so that you do not over-exert yourself, especially in the area of exercise.

The last team-building skill taught is managing conflict[12]. Part of this subject matter is covered by what is taught in team coaching when you act as a counsel. It is very important first of all to understand that conflict is inevitable and will always exist. Identifying the five myths about conflict is made. The next step is identify the stages of conflict from stage one or daily events to stage two, challenges and finally stage three, the action which identifies positive relationship during conflict. Developing approaches to conflict management is explained. The five styles of conflict management are then explained. These are integrating, dominating, avoiding compromising and obliging.

Each of these styles may be used in managing conflict, but be doubly sure to remember not to involve your emotions in solving the conflict. There is no right or wrong style; what you do is fit your style to the present existing conflict.

The emotional aspects of conflict is discussed. The three emotional dynamics of conflict are identified. The next lesson is the interpersonal gap or problems of communication. The next aspect is emotional reflexively moving away from cooperation. The few elements present of emotional reflexively are given.

The last aspect is effective intervention in conflict resolution. When both parties cannot resolve the conflict, an intervention team is introduced. The composition of the team is explained as well as what should the team should do. The intervention team will establish the parameters of conflict, collect data, reframe the users and finally generate the alternatives. When a decision has been made the rest of the team should then be informed of the decision. When all of this is taught and you will learn it well, you will be ready and be able to learn another team-building skill.

▸ CONCLUSION

There are two contradicting views of engineering education today in the Philippines. One view is that of industry which wants academe to train engineers so that they will be ready to work with them at once. The concept means engineering education should cover the practice-based aspect and less of the theory part. In the case of academe it believes that they should understand the theory and be trained for lifelong learning. How to balance the views so that both industry and academe will be satisfied with the graduate engineers that the engineering school produce? There are four important task of engineering education and these are the following:

a. Expanding intellectual horizon

b. Providing discipline-specific knowledge base

c. Preparing for lifelong learning

d. Teaching how to function in society

The first two task are already in the Engineering curriculum and may be considered "native" or indigenous to it, the last two had been ignored and so neglected. Recently, however, their importance was realized, making its inclusion in the curriculum vital.

The introduction of the subject on Team-Coaching and Team-Building will be a step in answering the need for engineering students to learn how to function in society. While it is true that it will not cover all the necessary areas, it is still a step forward. The introduction of preparing a self-development, team-coaching and team-building will equip students of the College of Engineering of Central Philippine University with know how to work with industry. It is unique since it is one of the first schools

to do so. It should be mentioned that some of these subjects are offered in the Management Engineering course but not in other engineering disciplines.

It is high time to find out if other engineering schools will offer this subject especially those in Civil Engineering. It is also very important to remember that these topics are being offered abroad and it is about time that our Engineering schools should offer it to abreast with the rest of the world of preparing our graduates.

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WATER LEVEL CONTROLLER

ENGR. RAMON A. ALGUIDANO, JR.

▸ INTRODUCTION

Background of the Study

Water tank level controller has been widely used in various countries of Asia and America including some parts of Europe.

Water level controllers come in different types such as floater type, the tube design, spilling type and many other types. The water tank level controllers have the ability to detect the water level on the tank and trigger the electric motor to pump water on the tank. Water level controllers are mostly used on huge water reservoirs from the ships during the critical condition in navigation. It is also used to prevent water input from reaching the limit of water level inside the vessel.

Many residences and manufacturing companies use water tank as water storage to ensure adequate amount of water supply. Oftentimes, the problem arises when the water level in the tank is unnoticed to be empty. Thereby causing major household chores such as laundry, household cleaning, dish washing and many more to be undone. Another problem is the running motor water pump unmonitored. The tendency is, the motor pump will be left running thereby causing water spillage and sometimes leads to malfunctioning of the motor due to heating.

To combat these problems, the researchers decided to design a device called AUTOMATIC WATER LEVEL CONTROLLER WITH INDICATOR.

Objective

This study aims to design a water level controller with attached indicator to determine the water content of the tank as well as to control the on-off operation of the electric water pump.

Scope and Limitation

This study was conducted at Magsaysay Village, La Paz, Iloilo City from September 25 to October 16, 2000.

This project is applicable only for constant water source like deep wells, irrigation and waterway systems. The device is only intended for an electric motor that has a running current not higher than 5 amperes.

Significance of the Study

The water level controller with indicator is important to residences, manufacturing companies and other business establishments that use water tank and motor driven pump to store sufficient amount of water for daily use. It can provide convenience and less effort to those who have water tank due to the controlling feature and indication of water level.

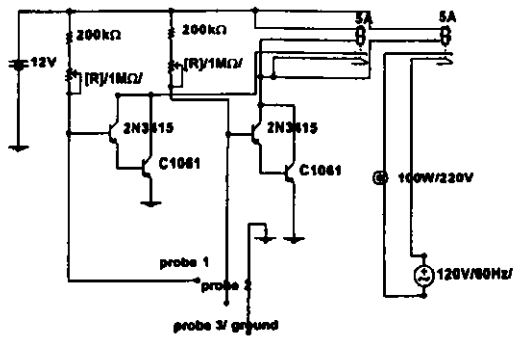
Furthermore, the use of the said device will minimize water spillage thus, conserving water.

▸ METHODOLOGY

Schematic Diagram

Circuit design

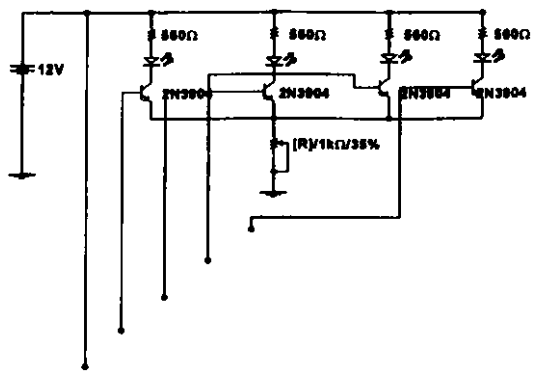
1. Water Level Controller



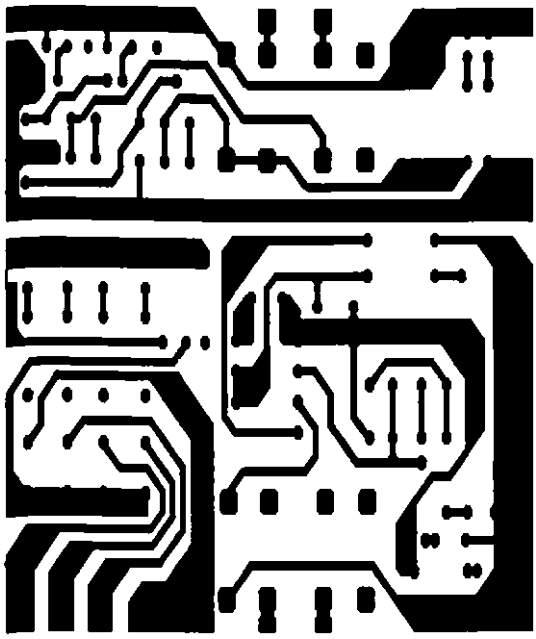
Note:

Water resistance serves as the base junction resistance and a resistance between probes and has the value that varies with temperature and mineral content of the water, which has an approximate range from 200 kΩ to 1MΩ.

2. Water Level Indicator



PCB Layout



- **CALCULATIONS**

A. Indicator

(Solution based on saturation region)
@ I_{CSAT}; $V_{CE} = 0V$
$b = 200$

H_2O Resistance = 250Ω to 1MΩ

Assumption:
$V_{LED} = 3\ V$
$R_B(H_2O\ Resistance) = 200\ k\Omega$
$V_{RC} = 3V$
$V_{RE} = 6V$

$12 - I_BR_B - V_{BE} - I_ER_E = 0$; but $V_{RE} = I_ER_E = 6V$

$I_B = (12 - 0.7 - 6)/200K$
$= 26.5\ mA$

$I_C = \beta I_B = (200)(26.5mA) = 5.3mA$

$I_E = (\beta+1)I_B = (201)(26.5mA) = 5.3265mA$

$R_C = V_C/I_C = 3/5.3mA = 566.04\ \Omega$

$R_E = V_E/I_E = 6/5.3265mA = 1.126K\Omega$

*The choice of R_E is to vary the intensity of LED

Controller

Given: Voltage Divider Biased (Darlington Connection)

$V_{CC} = 12volts$
$R_1 = 0 - 1M\Omega$
$R_E = 0\ \Omega$
$R_C = 150\ \Omega(coil)$

Required: V_{RC}, R_2 (maximum resistance)

Solution: $V_B = V_{BE1} + V_{BE2} + I_ER_E$; but $R_E = 0\Omega$

$V_B = 0.7 + 0.7$
$V_B = 1.4$ volts

By CDR

$V_B = V_{CC}[R_2/R_1+R_2]$
$1.4 = 12[R_2/1M\Omega+R_2]$
$12R_2 = 1.4M\Omega + 1.4R_2$
$R_2 = 1.4M\Omega/10.6$
$R_2 = 132075.47\Omega$
$132.075K\Omega$

For VRC

$V_{CC} = V_{RC} + V_C$; but $V_C = 0$ volts
$V_{CC} = V_{RC} = 12$ volts

Components Description

Components	Description	Quantity
Transistor (NPN)	C1061	2
	2n3415	2
	2n3904	4
Resistor	560 Ω, ¼ Watt	4
	1kΩ	2
	1MΩ (trimmer)	2
	1kΩ (trimmer)	1
	20kΩ	2
Switch	12VDC/5A	
	(DPDT relay)	1
	Push button (NC)	1
	Push button (NO)	1
	SPDT	1
LED	Jumbo type	6
	Push button (NC)	1
	Push button (NO)	1
	SPDT	1
LED	Jumbo type	6

Table 2. Materials and Accessories Description

Materials	Description	Dimension/ Quantity
Power Supply	12VDC/300mA	1
	12VDC/850mA	1
Pump w/ built-in motor	220VAC/4.4 watts	1
Connecting wires		
PCB	Single face	5x5 in.
Illustration board		1/8
Glue	Cyanoacrilic (bulldog)	1
	Glue stick	1
Prototype tank	Glass	9.4 x 9.4 x 15.5 cm
Hose	Transparent	1/2 m (length)
	Green	1/8 m (length)
	Chemical	1 in
Pipe	Copper	1/3 m (length)
Faucet	Plastic	1
Jack Plug	black	1

Construction .

The automatic water level controller with indicator was constructed with separate circuit for indicator and controller. It is supplied individually with 12VDC/300mA and 12VDC/850mA sources respectively. LED's indicator was constructed separately from the main circuit to provide more expansion for the setup. The prototype structure was patterned to the actual water tank that uses an electric motor to fill the tank.

▸ RESULTS AND DISCUSSION

Circuits Operation

A. Controller

The circuit is being supplied by a 12-volt DC supply. It is operated by a Darlington connection of C1061 and 2N3415 transistors. These transistors serve as a switch that drives the relay switch. A double-pole double-throw relay is driven by 12-volts DC supply with an 8-ampere coil. The variable resistor is ranged by a 1MΩ trimmer. This trimmer functions as an adjuster for the probes' sensitivity. A 20KΩ/ ½-watt resistor is placed as a protection for the transistor if it is reduced to minimum. Two LEDs are placed as an indicator (red light) for the operation of relay switch and (green light) for presence of supply voltage in the circuit.

The circuit uses three probes. Two of three probes were connected on each base of two primary transistors on the individual Darlington circuit. The remaining one is connected to the ground or the emitter of the secondary transistors. These probes are placed in different level: the common is placed at the bottom, probe 2 is placed in the middle and probe 1 is placed near the top of the tank. The probe 1 is connected directly to the base of primary transistor of first Darlington where the collector is connected to the normally open switch of relay. Probe 2 is connected to the base of the primary transistor of second Darlington where the collector is connected to the neutral point of relay. The characteristics of the relay switch helps transistor to keep on operation during the cut off of the other transistor. When the tank is initially empty the relay is "on state". When water level reaches probe 2, the second Darlington will "cut off", but the first Darlington still trigger the relay switch. When probe 1 establish connection with two other probes through water, the first Darlington will then be "cut off". At the time where water subsides the relay still on the "off state" until it passes probe 2 (see Logical Operation). In analysis, the first Darlington depends on the function of second Darlington.

B. Indicator

The circuit is supplied by a 12VDC/300mA. It uses a four 2N3904 transistor that has been cascaded into four and their emitter were connected into a trimmer of 1kΩ which serves as an adjustment for the sensitivity of the circuit. Every LED's were activated with individual cascaded circuit assigned as sensor for the level of the tank. Four LED's for every specific level of water tank indicate its general operation.

Logic Operation

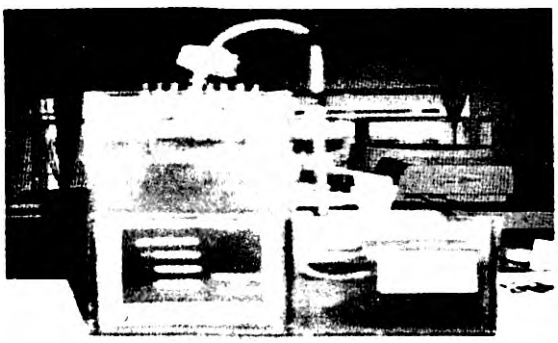
A. Controller

Common	Probe 2	Probe 1	Output
0	0	0	1*
1	0	0	1
1	1	0	1
1	1	1	0
1	1	0	0
1	0	0	1

* Water tank initially empty

B. Indicator

PROBE								1 OUTPUT
1	2	3	4	5	Z1	Z2	Z3	Z4
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
1	1	0	0	0	1	0	0	0
1	1	1	0	0	1	1	0	0
1	1	1	1	0	1	1	1	0
1	1	1	1	1	1	1	1	1
1	1	1	1	0	1	1	1	0
1	1	1	0	0	1	1	0	0
1	1	0	0	0	1	0	0	0
1	0	0	0	0	0	0	0	0



Water Level Controller Prototype

Price List

Quantity	Material	Item Price	Total Price
4	2N3904	P 10.00	P 40.00
3	2N3415	P 20.00	P 60.00
3	C1061	P 35.00	P 105.00
8	LED	P 3.50	P 28.00
1	LDR	P 35.00	P 35.00
1	IC	P 25.00	P 25.00
1	IC socket	P 8.00	P 8.00
10	¼ Watt resistor	P 0.30	P 3.00
2	Capacitor	P 12.00	P 24.00
2	Potentiometer	P 15.00	P 30.00
3	Trimmer	P 8.00	P 24.00
5 m	Lead	P 5.00	P 25.00
2	PCB	P 25.00	P 50.00
1 m	5 Color Wires	P 15.00	P 15.00
2	Relay switch (DPDT)	P 180.00	P 360.00
1	Pump w/ built-in motor	P 450.00	P 450.00
	Pump accessories	P 103.00	P 103.00
1	Water tank	P 600.00	P 600.00
1	Faucet	P 130.00	P 130.00
3	12 VDC, adapter	P 120.00	P 360.00
1	Aluminum sheet	P 80.00	P 80.00
1 m	Aluminum Wire	P 6.50	P 6.50
1	Ferric chloride	P 25.00	P 25.00
1	Push button (NC)	P 10.50	P 10.50
1	Push button (NO)	P 10.50	P 10.50
		TOTAL	P 2,607.50

▸ CONCLUSION

The researchers concluded that the AUTOMATIC WATER LEVEL CONTROLLER WITH INDICATOR could control the on-off operation of the water pump thereby controlling the level of water that entering the tank. Furthermore, the device can indicate the level of water in the tank.

▸ RECOMMENDATION

The use of AUTOMATIC WATER LEVEL CONTROLLER WITH INDICATOR is recommended for household and establishment with water tank and constant water source driven by the electric motor pump.

Moreover, the use of the said device varies depending on the power supply needed by the water pump. Thus, the researchers suggest that specific relay must be use for certain capacity of motor.

Further improvements and study on the device must be done in order to insure greater efficiency.

A STUDY OF MALIAO CREEK IN THE MUNICIPALITY OF PAVIA, ILOILO

ENGR. EDGAR MANA-AY & GEO 311 CLASS

By a group of Civil Engineering students taking Geo 311 – Engineering Geology under the advisorship of Edgar H. Mana-ay (Instructor)

Michael Contreras	Runin Gapilango	Jocelyn Gregorio
Nestor Javier	Alpha Famillaran	Alvin Salazar
Jeanymaersk Tina	Andie Villa	Roselyn Villo

Abstract: *The Municipality of Pavia in Iloilo Province was declared the Agro-Industrial Center (RAIC) for Region VI by then Pres. Corazon in 1989. Even before that time, industrialization and urbanization of the town has come into a fast pace and the issue of environmental protection was not given its due attention. Maliao Creek in Pavia is one of the many areas where environmental concern should be directed in order to stop its further degradation. In view of this, a group of 4th year Civil Engineering Geology, conducted a study on the extent of the environmental degradation of Maliao Creek over the last 50 years and provided recommendations for the restoration of its ecosystem.*

▸ INTRODUCTION

Fifty years ago, Maliao Creek was an environmentally balance ecosystem. The waters was teeming with fishes, shells and other marine life. All along the creek's banks flourishes bamboo grooves and variety of trees and very few bank erosion occur. On these bamboo grooves and trees, thrives a variety of birds, including the night owl which is now extinct. People were fishing with the use of fishing hook and line. DC battery back pack fishing was then unknown and many people whose hobby is line fishing enjoy their pastime at Maliao Creek.

Today, Maliao Creek is in a sorry state of environmental degradation. Its balance ecosystem is badly altered, perhaps beyond restoration. Only about 30% of the bamboo grooves and trees that cover the entire length of the creek is left. Tree cover is scarce and the only thick vegetation along the banks is the unkept, unattended cogon grasses. The water itself is highly polluted that even the mudfish is seldom seen at the creek. Farmers indiscriminately construct dikes across the river bad to impound water for irrigation purposes. Carabaos are made to stay at the creek bed creating pot holes and alter the natural grade of the creek bed. Because of the alteration of its geometric and hydraulic variables, and the disturbance of the balance of its ecosystem, Maliao Creek no longer provide a year round, constant flow of clean water. Its main role as a drainage outlet for Barangays Amparo, Palagon, Maliao and part of the Poblacion during rainy season has been greatly diminished.

Maliao Creek is considered to be a "man-made" creek because it was ordered to be constructed during the Spanish era at the close of the 18th century. The creek was intentionally built to serve as a drainage of rise lands of Barangays Maliao, Palagon, Amparo, Cabugao Sur and part of nearby town of Sta. Barbara. It also serves as a drainage outlet of a natural spring found at the boundary of Pavia and Sta. Barbara. The spring still exist and serves as the main source of water for the creek. From the Pavia-Sta. Barbara boundary and until it merges with the Aganan River, Maliao Creek has a total length of about 4 km and an average width of 10 m.

▸ PURPOSE OF THE STUDY

A. Ultimate Objective

To be able to present our analysis and recommendations to the Mayor of Pavia and its Municipal Council on how to restore Maliao Creek to its original environmentally balanced condition fifty (50) years ago. This will result in a year round flow of clear and clean water, a creek swarming with marine life and a habitat for birds and other wild life. We will also aim to establish a stream at grade or a stream at equilibrium where the hydraulic variables (water velocity, discharge and load) is balanced with its geometric variables (width and grade of bed, depth of water filled channel). Once this is attained, the creek can naturally adjust itself to achieve stable form ad profile appropriate to the available flow and sediment load.

B. Specific Objectives

1. Identify areas that need tree cover.
2. Identify eroded banks that need restoration work and determine the type of restoration work required.

3. Identify areas that requires erosion protection and determine the type of protection work.
4. Locate areas in the river bed requiring restoration work to return it to its natural gradient.
5. Identify meander sections requiring correction/ restoration so that expenditure of water energy during flood is best distributed.
6. Identify areas where channel width will require restoration to return it to its natural geometry.
7. To conduct a household survey of houses located within 10 meters of the river bank.
8. To identify all lot owners adjacent to creek's bank so we can establish a system of responsibility in the protection and maintenance of the channel bank.

▸ DISCUSSIONS

A. Maliao Creek as an Ecosystem

An ecosystem is a community of organisms and its nonliving environment in which matter cycles and energy flows. Understanding Maliao Creek as an ecosystem requires us to consider the physical, biological and hydrological processes involved in the area such as:

- Farming alongside the stream causes changes in supply of water and sedimentation to the stream system.
- Cutting of trees along the stream eliminates shading and cover for fish, while exposing the stream to the sun, which result in damage to plant life and heat-sensitive aquatic organism. It also eliminate the habitat of many animals and birds and also facilitate erosion and siltation.
- Straightening and modifying the stream bed destroys diversity of flow patterns, changes peak flows and destroys feeding and breeding areas of aquatic life.
- Conversion of a meandering stream to a straight, open ditch causes more Erosion downstream because energy of flow is not properly expanded.
- Indiscriminate and wanton dumping of garbage and waste into the stream Increases the Biological Oxygen Demand (BOD). Useful organism like fishes and shells will be starved out oxygen because of competition from bacteria.

B. The Concept of a Stream at Grade or at Equilibrium

Streams and rivers far from the constant reach and influence of man has over the years naturally adjusted itself to achieve stable form and profiles appropriate to the available discharge and sediment load. Such stream is in a state of equilibrium and is considered to be at grade. In such a system, a continuos inflow of sediment and water is discharged downstream, while the channel itself adjusts to slight variations in the contributing environment. The rates to import and export of material and energy become balanced, resulting in a channel that is essentially stable over a long period of time.

A graded stream does not presuppose a smooth unbroken longitudinal profile, rather it simplies an adjustability of the channel, reflected by short periods of scour and fill, in response to variations in the independent variables affecting the stream. A stream at grade will strive to maintain its capacity and competence so that they are just sufficient to transport the load provided with available discharge. It does this by mutual adjustment in its longitudinal profile and cross-sectional characteristics.

Based on the above concept, the recommendations made by the group who studied Maliao Creek is geared towards the return of Maliao Creek towards a graded stream or a stream at equilibrium.

C. Hydraulic Geometry of Stream Channels

The descriptive relationship among the variables (velocity, discharge, etc.) and geometric variables (width, depth, etc.) has been termed as the hydraulic geometry of a given stream. These interdependent factors interact with each other to produce the resultant channel form. Changes in the variables controlling length of the stream for the same flow conditions over a period of time. At different discharges, the measured average velocity, depth, and width of the flowing water reflect channel changes and provide insights into the factors which affect stream flow.

At Maliao Creek, a more detailed study (hopefully t be assigned to the next CE class) at different sections of the creek length will have to be made to determine which geometric variable will require correction to place the stream on grade.

D. The Channelization Controversy

Channelization of streams consists of straightening, deepening, widening, clearing, or lining existing stream channels. Basically it is an engineering technique, with the objectives of controlling floods, draining wetlands, controlling erosion, and improving navigation. Of the four objectives, flood control and drainage improvement are the two most often cited in channelization projects.

Experience in the U.S. showed that channelization while a necessity, has created considerable controversy and justifiable anxieties because of more adverse affects than benefits that it has created.

In the past, Maliao Creek had undergone some form of channelization as follows:

1. In 1980, during the construction of the IBRD Diversion Road which traversed the creek, portion of the creek where a bridge was constructed was straigthened and its banks ripraped.
2. In 1985 when the Kabasaka Road was constructed to connect Barangay Amparo to Cabugao Sur the same channelization work was made at the portion where the bridge was constructed.
3. In 1992 the meandering portion before the 1st Maliao Bridge was straigthened and concrete lined to prevent further erosion to a barangay road and to the bridge itself.

Adverse Effects of Channelization:

1. Increases bank erosion downstream from the straigthened and protected section. In No. 3 above, very serious bank erosion is being experienced down stream of Maliao Creek from the 1st Maliao bridge. Straightening of the meandering portion increased the velocity, hence the energy of the water flow to cause serious bank erosion.
2. It is commonly believed that channelization increases the flood hazard downstream from the modified channel. Although this is not an established fact, experience at Maliao Creek shows that there was in fact increased flood hazard/frequency after the three channelization work although other factors could have certainly contributed to this increase flood frequency.
3. Loss of biological aquatic life because feeding and breeding areas are Destroyed. In portions of Maliao Creek which was straigthened and banks concreted, trees cover were destroyed and this has greatly diminished marine life.
4. Aesthetic degradation of a natural area.

Guidelines in Future Channelization:

1. When the primary objective is drainage improvement in areas where natural flooding is not a hazard, then there is no need to convert a meandering stream into a straight ditch.
2. Consider first the cleaning of the channel and maintaining a sinuous stream.
3. A reasonable trade-off will be to straighten the channel less, still providing a measure of flood protection without causing serious erosion down stream and rapid environmental degredation. A sample of an ideal channel profile to induce scour and deposition at desired location is shown below:

E. DENR ADMINISTRATIVE ORDER NO. 97-05 dated March, 1997

SUBJECT:

PROCEDURE IN THE RETENTION OF AREAS WITHIN CERTAIN DISTANCES ALONG THE BANKS OF RIVERS, STREAMS, AND SNORES OF SEAS, LAKES, AND OCEANS FOR ENVIRONMENTAL PROTECTION

This is the implementing procedure of the provisions of R.A. No. 1273. P.D. No. 705 (as amended) and P.D. No. 1067. Pertinent portions of this Administrative Order are listed below to show that the citizenry and more so with the local Municipal Officials are mandated by law to protect rivers and streams:

1. Sec. 1.1 – Areas needed for the forest purposes shall be twenty meters strip of

   Land along the edge of the normal high water line of rivers and streams with channel of at least 9 m wide.
2. Sec. 1.3 – The banks of rivers and streams throughout the entire length and within a some of 3 m in urban areas are subject to the easement of public use.
3. Sec. 1.4 – This strip of land shall be retained and preserved as permanent forest for stream or river bank protection and are non-alienable.
4. Sec. 2.1.2 – This strip of land shall be demarcated as separate lot and to be retained as permanent forest. This may form part of open space for parks and recreational areas which shall likewise be planted with trees.
5. Sec. 2.3.1 – The boundary lines of survey shall be 40 m in forest areas, 20m in agricultural areas and 3m in urban areas measured landward from each side of the bank of the river or stream.
6. Sec. 2.3.4 – The strip of land for stream or bank protection shall be kept with vegetative cover

and planted with trees. Sufficient measures shall be undertaken to prevent soil erosion.

▸ RECOMMENDATIONS

1. Passing of municipal ordinance on water impounding and pumping.
   a. There shall be no building of earthen dike across the river bed for water impounding purposes.
   b. Pumping of water will be for irrigation/farm purposes only. Suction line should not exceed 3" dia. And a suction hole at the river bed should not exceed 1 x 1 x .5m size
2. Declaring the creek and its adjacent surrounding within 10m from the bank as a bird Sunctuary and a mini forest and public recreation area. This in line with the program of Sen. Loren Legarda of establishing a mini forest in all municipality. Pavia, being an urban and highly industrialized town will have no other area to fulfill this requirement except along the banks of Maliao Creek. The Municipal Council should pass laws imposing punishment to bird hunters within the prescribe sunctuary and also to those who would cut and burn trees and vegetative cover.
3. Regulation of fishing at Maliao Creek. Impounding of water for fishing purposes should not be allowed. Use of chemicals such as "Decis" and use of DC electricity in fishing should be strictly prohibited. The municipal council should pass laws to this effect and impose punishment to violators. Only hook and line fishing will be allowed.
4. Prohibiting the throwing of garbage into the creek and its adjacent areas. There is already an existing anti-littering law and all that is needed is the strict implementation by the local government. As shown in earlier discussion, garbage in the creek increases biological oxygen demand (BOD) thereby starving the fishes of its oxygen requirement.
5. Planting of trees and establishing a healthy vegetal cover within 10m on both sides of the bank. 50 years ago the entire bank was covered with bamboo groove planted from way back the beginning of the century. The 70% which is now gone should be restored. Bamboo grooves will cover from the bank up to 3m and then mahogany trees from the 3m line up to 10m.
6. Restoration of badly eroded banks and pot holed river bed. Because of time constraint, the first study group have identified portions only of areas of severe bank erosion and irregular river bed surface as indicated in the attached map. The second batch of CE students will continue the survey and complete the identification of all geometric variables which needs restoration. Future channelization work on Maliao Creek should be studied carefully and should be referred to expert on hydrology and geology before implementation to assess its adverse effects.
7. Endorsing of responsibility of protecting and maintaining the creek to the lot owners directly adjacent to the creek. Based on the Municipal Assessor's record, the 1st study group have listed 50 land owners adjacent to the river bank. Personal verification of these lot owners will be done by the 2nd study group. After verification, it is recommended that the Mayor call these owners and endorse to them the responsibility of protecting and maintaining Maliao Creek adjacent to their respective lot.
8. Creation of a permanent governing body (Example: MCA-Maliao Creek Authority) who will be given the authority and responsibility to plan and implement short and long range programs in the restoration and maintenance of Maliao Creek. The Municipal Council should initiate the creation of this body and provide it with an operating budget.
10. Lastly, involving the civic, religious and non governmental organization in Pavia to take part in the restoration and maintenance of Maliao Creek. Pavia, being a growing industrial town, has many of such organization. They can adopt some portion of the creek as their project.

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Control of Erosion

National Research Council

Transportation Research Board

A SIX-YEAR CIVIL ENGINEERING CURRICULUM*

GERARDO G. GEPULANGO

Abstract: *Today's civil engineering graduates of the Philippine Engineering schools are hardly recognized as such in most countries of the world. One reason for this could be the fact that it takes only fifteen years to earn a complete Civil Engineering degree in the Philippines while it takes a minimum of no less than sixteen years in the rest of the world. In order that this sorry state of affairs civil Engineering education may be remedied, an endeavor to correct this unfortunate situation in Civil Engineering education, the College of Engineering of Central Philippine University implemented the six-year Civil Engineering course beginning school year 1999-2000. A six-year civil Engineering degree course offers A salient advantages, one of which is the opportunity to devote an extra year to cooperative education. Cooperative learning develops in the student abilities, expertise as well as know-how in dealing with practical problems – qualities which are indispensable tools when the graduate practices his profession. The six years required by this degree course can actually finished in five years; the student, however, must put in four summers of work and on-the-job training to qualify the extra year.*

▸ INTRODUCTION

In education "learning by doing" can be very effective. Engineering students need to have an experience in critically appraising real problems and solving them efficiently and economically. Many of the engineering employers want graduates who not only have technical skills, but interpersonal and creative skills as well.

It must be remembered that engineering education should not only be concerned with the acquisition of knowledge but more so with the application of that knowledge. A curriculum must be designed where appropriate activity must involve application of the theory. It must also give students many opportunities to develop practical sense of these applications as well as adequate sound judgment. It should also provide students with a disciplined and creative approach to the analysis of solutions.

It is not suggested that the content of an engineering course should have more "engineering" in it, it is strongly believed that engineering courses ought to be liberalized or "liberated". Engineering subjects therefore, need to become more practical, a hands-on type of subjects.

Engineering education aims to prepare students to pursue progressive and productive career. The objective of the Commission of Higher Education (CHED) in adopting and promulgating the Curricular Guidelines for Engineering Education in 1997 for the Higher Education Institutions (HEIs) is to make engineering education relevant to local conditions, linked to industry, and at the same time be internationally competitive. While there is an oversupply of engineers, as evidenced by high unemployment and misemployment rate, the demand and supply of appropriate and quality engineers have been generally inadequate to meet the requirements of the industries. What the industry desires is high quality engineers who are responsive to their needs and requirements.

Today, in order to be industrialized and economically competitive, our country must have an adequate number of qualified technicians, technologists and engineers who will produce, install, operate and maintain state-of-the-art equipment; train and supervise the industry's skilled workers and support research and development efforts.

The engineering enterprise has become increasingly global. This means that an engineer faces more stiff competition than before. To compete for work in a global economy, an engineer must be technologically adept and must aim for top quality work. Our present educational system emphasizes the acquisition of knowledge rather than practical skills. To globalize education, there is a need for the integration of knowledge and practical skills. On-the-job training is dominant in the Japanese industries and this training proves to be more effective on Japanese learners. Miss Cindy Chen-yuan, a fresh graduate in building surveying of The Hong Kong Polytechnic University felt that " it would have increased her competitiveness in the job market if she had exposure to site inspection and more training at the Industrial Center on campus. These are just a few scenarios showing the need to improve our engineering curriculum in order to be globally competitive. Institutions of higher learning should evaluate the effectiveness of their curriculum and use the results of the evaluation for continuous planning and improvement of the process.

* *Presented at the National Congress on Civil Engineering Education De La Salle University 2000*

Development of the Six-Year Civil Engineering Degree Program

Central Philippine University, College of Engineering followed the curricular guidelines set up by CHED and to come up with the revised five-year civil engineering curriculum. This five-year civil curriculum was further refined which resulted in the Six-Year degree program. Three things were noted during the process of revision:

1. First, the mission of Central Philippine University which is "Exemplary Christian Education for Life or EXCEL" was meet. The curriculum includes six units of religion and ethics courses.
2. Second, viability of program in terms of number of students enrolled in the technical courses was considered. All courses except non-technical will be taken up at the same time by both students in the five-year and six-year degree programs.
3. It is worth noting that Engineering in the Philippine schools have more number of units in technical courses as compared to that of US schools. Moreover, in the US schools Civil Engineering subjects have areas of specialization while in the Philippines CE subjects cover almost all areas of Engineering practice.

▸ OBJECTIVES

The six-year Engineering degree program was prepared with three primary objectives namely:

1 To become globally competitive. Increasing the number of years in getting a bachelor's degree in engineering from five to six years is now comparable to the rest of the world in terms of the number of years of completing an engineering degree from elementary to tertiary level. The one year is equivalent to ten months of on-the-job-training which will enhance the technological skills of the students.

2. To develop and strengthen academe –industry linkage and partnership. The extra year is devoted to cooperative education. Here the industries cooperate in the training of the students. Cooperative learning is one way of improving learning process and develops in the student the following:
   a. Abilities in knowing, dealing, and probably solving practical problems
   b. Specialization and expertise
   c. Interpersonal, teamwork and management skills which are indispensable tools in the practice of the engineering profession
3. To offer a six-year engineering degree which can be completed in five years and four summers.

▸ COMPARISON OF THE FIVE-YEAR AND SIX-YEAR DEGREE PROGRAM

1. Both programs can be finished in five years. However, in the six-year degree program, the students must put in additional two summers of course work and two summers of on-the-job training during the period.
2. Only students who do not have failing grades are qualified in the six-year degree program. Those who are qualified are free to choose any one of these two programs. However, those who have good grades are encouraged to take the six-year program.
3. A ten-month on-the-job training is required for the six-year degree program while only about 100 to 250 hours on-the-job training is required for the five-year degree program.
4. Only students undergoing on-the-job training in the six-year degree program will be given financial assistance.
5. The sequence of the offering of technical courses is the same for both program but not the non-technical courses.
6. In the last semester of the fifth year, those on the six-year degree program will have their on-the-job training, while those on the five-year degree program will take up non-technical courses.

- A sample of each of a five–year and six-year curriculum is shown on the following page.

▸ ADVANTAGES OF THE SIX-YEAR DEGREE PROGRAM

1. The six-year degree program can be finished in five years.
2. There is a possibility that a graduate of a six-year degree program has better chances of employment after graduation not only locally but more so abroad.
3. On-the-job training develops in the students teamwork skills not only among other engineers of different disciplines but also among other technical and non-technical personnel.
4. The graduate will be better prepared to work in a global environment not only because of his exposure to industry, (especially an industry involved in information technology) but also because he has finished a six-year course.
5. Because of the wider industry-academe partnership in teaching, a collaborative research activity might be developed.

▸ DISADVANTAGE OF THE SIX-YEAR DEGREE PROGRAM

1. Extra time spent to finish the six-year degree in

five years will mean limited rest time. As they say, "There is no time for love."

2. A student should aim for good grades, otherwise, the degree could not be finished in five years. A student in the six-year degree curriculum is only allowed three failures in five years and four summers.

3. The number of students entering the program will be limited.

▸ PROBLEMS

The program is still in its infancy. The following are some of the problems that the program may meet:

1. Statistics show that about 20% of the entering freshmen finish the five-year course in five years, and about 10% finish in more than five years. At present, only about 15% of the entering freshmen are qualified for the six-year degree program. If the 15% intended to take the six-year degree program, will they graduate in the year 2004?

2. Presently, CPU has a strong academe-government-industry linkage in Iloilo because of a memorandum of agreement between CPU, the government and industries in Iloilo on-the-job training. Will other industries outside Iloilo, particularly in Manila, accept of students for on-the-job training?

3. The students as well as the faculty adviser need financial assistance during their ten-month on-the-job training. Although there are possible fundings for the program, will the fund be sustained?

4. Are qualified students willing to take the six-year degree program, when five straight years are devoted to studying learning and with only a limited number of time for recreation?

5. Will the student be admitted to the program when he/she expects to finish in six years instead of five years?

6. Will government assistance be sustained?

▸ RECOMMENDATION

It is expected that the first graduate under the six-year program will be on 2004. During this five-year period, the following are recommended:

1. The program must be supported by the government. The government should support the program in terms of legislation as well as financing. The government should offer incentives to industries joining the program. The government, particularly CHED should allocate funds for the allowances of students undergoing on-the-job training.

2. The program must also be strongly supported by the industry. Adequate training as well as financial support in the form of allowances or scholarship should be afforded to the students. The industry can be certain of quality engineers.

3. The school shall solicit financial support from foundations and successful engineering alumni.

4. Since the program needs financial support, the school shall establish a fund to sustain the program.

5. The school shall establish an industrial center that will manage the activities to strengthen the academe-industry linkages and eventually make this program successful.

▸ CONCLUSION

It is hoped that a student who finishes a six-year engineering degree will satisfactorily meet the needs and demand of industries, both local and international, for quality engineers. In addition, with the support of the government, industry, alumni, parents, and students, the program will flourish turning out graduates who will be globally competitive and successful.

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DESIGN AND PERFORMANCE OF A PAPER AIRPLANE

PAUL LORRET AMAZONA

SYNOPSIS

There is a problem existing in most engineering curricula in the Philippines at present. The problem is the lack of an engineering subject, which will allow first engineering students to understand what engineering is all about. To solve this problem Engineering 121 was introduced in all engineering curricula in the College of Engineering of Central Philippine University. One of the important components of the curricula is a design contest for all first year students enrolled in this subject. The design component is simple what is important are the students learning what is needed in the undertaking the design process. This paper explains what was done during the design competition in the making of a paper airplane

▸ INTRODUCTION

Engineering 121 is also known as Freshmen Project Design, which is its course title; Central Philippine University offers it to first year engineering students. It constitutes one academic unit. This subject is a laboratory subject and meets three hours a week. This course covers a design contest, what engineering proposals should include, how to make oral presentations, how to make projects, how to write final reports, and on identifying the audience. It is learning how to write a report, make the objective of the report, and present the report. The Freshmen Project Design Program is managed by a Course Coordinator who is responsible for organizing the course, presenting lectures, insuring that design teams are formed and are aware of course requirements and sets the deadlines.

The goal in offering Engineering 121 is to orient all first year engineering students what engineering is all about and is needed. The objectives of the subject are to: provide students with an experience and background on their chosen field of study, look for solutions for problems in our daily lives through designing and assembling, prepare the students for more advance courses in their fields of study, and teach students what goes on in the entire design process including Proposal and Final Report making.

One of the most important components in the subject is the design competition for all students. It seeks to teach students what to do in competing with others when undertaking a design project. The design selected for this competition was the design of a paper airplane, which will fly the longest distance, the longest time and perform the best aerobatics.

Paper airplanes are simple and inexpensive toys made by children of all ages. Although this can be made by almost anyone considering its practicality and simplicity, the designs involved in making paper planes varies. The structure itself includes many properties to consider like gliding flight, ascent, aerodynamics, etc. The reason for the contest is to motivate design teams to brainstorm and create innovative designs for a paper airplane. This will help them exercise their analysis, judgment and teamwork. After the contest, this will enable teams to reflect and evaluate their design and its efficiency. This may also help them answer what went wrong, what made it successful or what should be done to make the design better.

Upon completion of this design project, each student in the team will be able to demonstrate creativity in designing paper airplanes by:

1. Creating and testing designs to compete in the areas of longest flight duration, longest distance traveled and aerobatics.
2. Creating designs that have predictable performance characteristics in terms of longest flight duration and longest distance traveled.

Preliminary Work

Working in teams of 5-6 students, each design team is required to construct paper airplanes to compete in the categories of longest distance traveled, longest duration of flight and aerobatics. Teams must submit a maximum of three different airplanes, one for each category in the competition. Hybrid designs are acceptable too, and in fact, encouraged. (Note: a hybrid design would be the case where a single airplane design becomes appropriate for competing in two or more categories). Other rules of the competition are as follows:

1. All planes must be constructed using no more than three ANSI-B size sheets (17inch X 11 inch) or three ISO-A3 (420mm X 297mm) size sheets.
2. All planes should be constructed of paper, tape,

thread, glue, and weatherproof coating. Paper clips may be used as ballast weights. No other materials/items are allowed.

a. All paper aircraft must be hand launched. No rubber bands, catapults, rocket engines, linear accelerator or the like will be allowed.

b. All planes must be heavier than air. No hydrogen, helium, or hot air is allowed.

c. Each team should compete in all the three categories of distance, duration and aerobatics defined as follows:

   i. Distance- is determined as the greatest distance from the point thrown to the point of impact with any solid object.

   ii. Duration- is determined as the greatest flying time from point of release to the point of impact with any solid object.

   iii. Aerobatics- is defined as the art of precision flying where pre-set patterns (called maneuvers) are drawn in the sky by the airplane to form a sequence or schedule. Loops, rolls, vertical flight, level flight and inverted flight are the typical elements involved. Each of which has corresponding points. The one with the highest point is considered the winner

A total of around 500 students enrolled in the first year classes joined the competition. Participants include only those who are bona fide students of Central Philippine University taking up Engineering 121. They work in teams of 5-6 members. The technical advisor is responsible in seeing to it how each group will design their project.

▸ PLANNING AND DESIGN

A team of 6 members joined the contest. They review the rules and brainstorm ideas. They decided to research properties of paper airplanes that are vital in the competition. They learned that aerodynamics plays a big role in the efficiency of paper airplanes. The discussion about aerodynamics includes the understanding of gliding flight, throw, ascent, dihedral, anhedral and folding time. They also discuss certain factors like weather that might affect the condition of the paper plane during the contest and brainstorm ideas how these can be handled. After understanding the properties of a good paper airplane, the team decided to look for existing paper airplane models that can be innovated to meet the demands of the contest. The best and the most common source the team used is the Internet. It has a wide coverage of existing paper airplane designs. Some designs already won an award, so it's good to know the properties that made it successful.

After data has been collected, the team decided to test the paper airplane models in the Sports Complex in Iloilo. They chose three best paper airplanes from the test to compete in the three categories. They focus on those models and brainstorm how they can make it more efficient. The design that they will use to compete in aerobatics was patterned to the propeller of an electric fan. The rule states that the winner in this category is determined by the most number of points. Points are based upon the number of tricks performed by the plane. For example, a roll has a corresponding 6 points, if the paper airplane rolled three times it will have a score of 18 points. Knowing that the propeller is really designed to spin fast, the wings of the plane are shaped like it. Paper clips were also added on the plane's bumper to add weight on that part and cause it to spin radically. The performance of this paper airplane met the design team's intention to let it spin or roll fast.

▸ INITIAL DESIGN COMPETITION

All students in each section had a preliminary contest first, with the supervision of their technical advisor. Design teams of the same section will compete in the three categories. Winners in the preliminary contest will compete for the final. Each section must have a maximum of three different design teams to compete for the final contest. Design teams who won in the preliminary contest will represent their section in the category they have won. Appointed contest officials will supervise the final contest.

▸ FINAL CONTEST

Design teams assemble at En200 for final briefing about the final contest. Rules were reviewed. Only those teams who won in the preliminary contest where allowed to join the final. Php 500 will be given to the winners of each category. Only one team may be declared as winner in each category. The contest proper started right after the final briefing. The contest was held in front of Rose Memorial Auditorium. A total of 15 teams representing one section each prepared their paper airplanes. Contest was divided by categories. In each category, teams are given three trials to fly their airplanes. The best result in the three trials will be considered. Previous rules were followed in determining the winner of each category.

▸ RESULTS

Two design teams won the contest. One team won in the longest distance category. It was estimated that the total distance traveled by the airplane was around 80 meters and this bested the other 15 teams. The team was given the price of P 500. The other team won the longest flight category and recorded a time of flight of almost 25 seconds. The same team that won the logest flight category won the third contest, which was airobotics. They therefore won a total amount of P 1000.

▸ CONCLUSION

The members of the team who won in the longest flight and aerobatics category were very happy because they can use the amount to fund their upcoming proposal. Resourcefulness and being innovative really made a bi deal in the team's success. They found a world record paper plane for the longest flight in the Internet. They used it and as a result that plane proved its world record capabilities. The plane that was used in aerobatics was just a simple dragon plane. It was only modified. Its wings were pattered to the propeller of an electric fan. As a result the plane spinned radically like a drilling machine. The judges didn't even count the rolls because it was too fast to be counted. What was used to determine the winner was the visual analysis of the no of turns each airplane made.

The team learned the value of planning and brainstorming. A good design usually comes from a good plan if not always. It is good to have a background first of what you are doing before getting involved with the real thing. Research work is a big help in gathering resources and information. A good background is needed in a good procedure and a good procedure is needed in a good result. Therefore, the quality of the finished design depends on the quality of planning and procedure.

There are several important concepts we learned from the competition. The first was presenting a design proposal. We found what was needed and what did we do was important in the presentation process. The second important trait we learned from the competition was understanding what the design process consisted of. The final important trait we leaned was understanding what is engineering generally all about based in the undertaking of the design project. This understanding will now make us realize what engineering is all about. This in essence is what we did in undertaking a paper design contest which was part of the first year design project.

CONTINUING ENGINEERING EDUCATION IN THE PHILIPPINES*

WALDEN S. RIO[1]

Abstract: *The need for engineers to undergo Continuing Engineering Education (CEE) in the Philippines is urgent. This is because there is a rapid change in the knowledge and engineer must now possess. The CEE Program describes how it is undertaken to help Civil Engineering Teachers in the past. An innovative teaching method is now being introduced to any engineering teachers in order to undertake a paradigm change in his/her method of teaching. In doing this, it is envisioned that a better teaching-learning cycle will take place in the classroom. This will be undertaken for selected teachers of Engineering Schools in the Philippines*

▸ INTRODUCTION

The Philippine educational system largely uses the chalk-and blackboard method of teaching. This method is used in all levels, even in most schools of Engineering, since the beginning and, unless changes are made now, will still be used in the unforeseeable future. The outcome of such a method is there for everyone to see. While it served its purposes, modern times make far more specific demands than such antiquated methods can take to deliver.

In majority of engineering schools an engineering teacher is hired to teach in the College of Engineering. More often than not, the new teacher has had very little, if any, industrial experience to be able to relate the subject matter he will teach to the practice of the Engineering profession, at the same time lacking the educational training and expertise to teach. A paradigm change the teacher uses to teach will remedy this problem.

The paradigm change is a need to train teachers in educational methods using the latest innovative methods. This can be done using the Continuing Engineering Education Program. However very little work is done on this area in the Philippines today.

When a school undertakes a Continuing Engineering Education Program, questions like, "Why do you do it?" are asked. One answer is so that the teachers of other schools may avail of CEEP to help improve them. Another reason is that CPU, as one of the Centers of Development considers it an obligation to assist other schools in their development, particularly in CEEP. The most important answer could also be that a school can comfortably undertake CEEP without worrying about competing with CPU. And lastly, if CPU does not undertake CEEP to assist other schools, who else will do it?

CEE Work Undertaken

During the past fifteen years the CPU College of Engineering has undertaken a very intensive Continuing Engineering Education Program. The CEEP tried to answer the need for civil engineering teachers all over the Philippines to be trained to undertake the correct laboratory exercises. The results of the CEEP have been more than what was envisioned. A total of 45 seminar workshops has been undertaken with more than 846 teachers coming from 115 civil engineering schools attending the seminar workshops.

The CEEP has done more than what was expected when it was first started. One very important aspect of these workshops was the introduction to the participant how to use locally fabricated equipment. In doing this schools will able to fabricate their own equipment, at the same time reduce the cost of acquiring the laboratory equipment they need.

In the late 1980s the college of engineering started undertaking innovative teaching methods. The first method tried out was using the Open Laboratory. This was followed by several methods such as large lecture classes and then small discussion classes. The first year design project then followed together with the use of Cooperative Learning. The project based and problem-based teachings were also introduced.

The latest innovative method is the preparation of an ABET outcome-based syllabi. This is a unique method of preparing a syllabi since it requires the use of an assessment method to determine what the results will be. Another innovative method is for the faculty to prepare a self-development plan in order to determine the future of the faculty member. The instrument used is known as the faculty self-development plan and each faculty member in the College of Engineering is required to present a five-year plan at the end of the semester.

CEE Innovative Teaching Method

In 1994 after attending an American Society for

* *Presented at the International Conference on Continuing Engineering Education Toronto Canada 2001*

Engineering Education Conference in Washington DC the undersigned realized that a lot of innovative methods was available for engineering teachers to use in the US also be possible in the Philippines. After a short period of trying out these innovative methods it was decided to try these out in a more intensive form. At the same time the undersigned attended more ASEE conferences and obtained more additional references.

Several references were also obtained by the undersigned from several authors of the papers on various innovative methods. References presented in several conferences on engineering education in Southeast Asia were also obtained. In addition several references were obtained through the www and also books on engineering education.

The undersigned presented several papers based on the results of using the innovative method and additional references. This paper was presented in several conferences locally and abroad. A year ago it was decided by the College of Engineering of Central Philippine University that the use of innovative teaching method be made part of its continuing engineering education program.

In order to do this funds were needed to undertake the CEEP. A funding agency was selected and sent the proposal. A grant was given by one agency to undertake the CEEP program to introduce innovative methods to improve teaching for new teachers of engineering schools. This funding agency is the United Board for Christian Higher Education. Another funding source was the award to the College of Engineering of CPU given by the government agency responsible for higher level education, known as the Commission on Higher Education.

A team of five teachers was then selected. Four of the team members came from the College of Engineering. Almost all of them were experienced teachers and had used some of the innovative programs in one time or another. In order to relate the training program to educational principles a consultant from the College of Education of CPU was included in the team. This teacher was also deeply involved in using innovative methods in teaching.

The coverage of the training program was then determined. In order to do this several references on teaching new teachers on how to teach was evaluated. The first reference used was the book on "Teaching Tips"[1] by MacKechie which is a very popular reference book for new teachers. The next reference was the manual "Effective Teaching A Workshop"[2] by Dr. Richard Felder and Dr. Rebecca Brent. The book "Teaching Engineering"[3] by Wankat and Oreoviez was also selected as a reference together with a paper on "A Course on Teaching Engineering"[4] by Susan Montgomery and "Teaching Teachers To Teach Engineering"[5] by Jerry Samples. The final reference used was "Teaching Workshop"[6] by Susan Ambrose. The manual on mentoring the mentors was also used as a reference for mentoring program.

The team then evaluated all the references and agreed to the coverage of the training program. The team agreed that the training program would be known as "Teaching Teachers To Teach" or T 4. The title was based on the title of the training program used in West Point for new teachers. The team members were then assigned specific areas to cover. The first was on the area of introduction to innovative teaching, how students learn and what should teachers teach. The second team member covered cooperative learning. The third team member covered the area of the engineering student. The fourth team member's area was on subject preparation. The last team member's area was on values and assessment.

The team then ran this training program in a seminar for teachers of Central Philippine University in May 2000 with around 28 participants from different colleges attending. Although the original idea was to use this only for engineering teachers who were new, it was decided to use this to include new teachers from any college. The results of this seminar-workshop were then evaluated.

In October 2000 the team went to another school to undertake a similar seminar as part of its CEEP. The participants were more than 60 and came from 8 schools and some problems were encountered. The team also evaluated the results to find out what problems were encountered. The results were then compared to the results of the first seminar-workshop held at CPU.

Among the deficiencies listed was the lack of base line data to determine the performance of teachers who participated in the seminar-workshop. This data was needed for comparison to the evaluation of the teacher's performance at the end of the year. The second problem encountered was the lack of interest among the participants at the end of the seminar to try out the innovative methods used in the lecture. The third problem was the need to use this training program only for new teachers.

In order to rectify this problem a second training program was scheduled in late December. Among the additional provisions made were the assessment made by the students under each participant to gauge

the teacher's performance. The teacher was also asked to assess himself based on the coverage of the subject matter using another instrument prepared for this purpose.

In order to maximize the impact of the training program it was decided that all participants to the seminar-workshop would be new teachers. The reason for this decision was it was felt that new teachers should start their teaching process correctly rather than allow for them to learn from experience, which would take a long time.

The workshop on Teaching Teachers To Teach was then held and each participant was required to attend all other sessions and a four-day workshop. In order to motivate the participants to really understand what was being presented a lot of group dynamics as well as questions and answers were used in the workshop. The coverage of the workshops was decided a few months ago.

In order to assess the performance of workshop speakers an evaluation instrument was filled up by each of the participant at the end of the each session. This evaluation will be used when future seminar workshops will be undertaken. In areas in which the performance of the team members was not satisfactory, provisions will be made for improvement.

In order to determine if the participants will now apply what they have learned in attending the T 4 seminar-workshop another process will be used. This is known as the mentoring the mentors. The team will divide the total number of participants into groups of 4-5 participants. One team member will supervise the performance of the 4-5 participants for a period of two and a half months. The supervision that will be undertaken will consist a group meeting every two weeks to thresh out problems the new teachers are encountering while they teach. These meetings will be scheduled during the noon break and will be a lunch meeting in order to allow all participants to attend the meeting and not miss their classes. In the month of January as well as February, two additional innovative methods will be explained which well reinforce whatever knowledge the new teachers have been able to learn. A feedback with all the team members of workshop participants will follow after the snap workshop. The purpose of this process is for the participants to present their problems and what would be possible solutions.

Another evaluation of the teachers' performance will be undertaken before the end of the semester. The evaluation will be done on the same class that the original evaluation was undertaken. At the end of the semester the team will evaluate the results to find out if the new faculty really improved their teaching process. The participants will also be requested to evaluate the entire program to find out what was its impact on their teaching. All in all therefore the results will be based on the teachers assessment form before and after the teacher had attend the teaching session as well as the mentoring the mentor program. Additional results will be the assessment of the teacher on the coverage of his/her syllabi and finally a brief report by the teacher of his understanding if he felt a self-satisfactory and improvement in undergoing the training program.

A final report will then be prepared and presented to the funding agency. At the same time however additional funds will be so that future seminar-workshop on T 4 can be undertaken as well as mentoring the mentors based on their experiences of running the workshop several tons.

▸ CONCLUSION

It was the belief of the team that the T4 program together with its mentoring the mentor could really help new teachers improve their teaching process. If these programs are replicated in other schools more teachers who did not have any experience would be able to easily learn the tricks. The Continuing Engineering Education program, if successful will solve some of the problems that were given in the first part of this paper. At the same time with a better teaching efficiency perhaps students will learn more from their teachers. In the end we can say it was well worth the effort of doing this continuing education program.

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ON MULTIPLE INTELLIGENCES

CELIA PALOMAR SUMAGAYSAY

▸ INTRODUCTION

MANY KINDS OF INTELLIGENCES

In what ways are students "smart"?

Do you have some who can create beautiful pieces of visual art? Are others gifted in sports, making complex series of physical movements which appear graceful and effortless? Some may play a musical instrument so well that listening touches the chords within. A few may thrill to the challenge of mathematical precision. Others may love writing and have already learned the excitement of seeing their own stories or poems in print. Several may be natural leaders offering positive role models and trusted guidance to their classmates. And a few may possess penetrating personal insights about who they are and what they stand for, while pursuing important life goals. Among the students mentioned, who would be the most intelligent? The question is impossible to answer because each of the examples represents students who have developed different intelligences. Each student is unique and all in individual ways offer valuable contribution to human culture.

As teachers how we educate our students in the 21st century? Do we create "smart environment" for our students to live and to learn? The new field of research on "distributed cognition" suggests that intelligence extends beyond individuals and is enhanced through interactions with other people, through resource materials in books and data-bases, and through the tools we use to think, learn, and problem-solve such as pencils and paper, notebooks and journals, calculators, and computers.

Take a moment to reflect upon our classroom environment. How is it "smart?" Are there sufficient opportunities for students to interact with each other in pairs, small groups, or as a whole class? Are resources available in the form of books, magazines, other publications, bulletin boards, artwork, posters, computers, databases and networks? Are there plenty of tools to use in learning and problem solving? Do students have their own journals? Do we find ways to create environments that foster the development of all the intelligences? Do we give our students opportunities for the creative exploration of their individual interests and talents while also learning valued skills and concepts through multimodal means? Not all students exhibit the same intelligence profile, nor do they share the same interest. In an age of exploding information, none of us can learn everything, choices ultimately must be made about what and how we will learn. In making such choices, the student's individual inclinations and interests should guide some of their curricular options. (Campbell, 1996).

The basic knowledge that all students must master, such as mathematics, history, language arts and science does not need to be taught in the same manner for everyone. Frustrations and academic failure might be greatly reduced if teachers present information in numerous ways offering students multiple options for success. Teachers should acquire "intelligence fair" methods of perceiving students and their talents, of designing curriculum and assessment approaches and of nurturing individual capacities so that each child may experience the pleasure of gaining skill in an area of intrinsic interest. (Dunn, 1992).

Let us reinforce the fine work that many teachers are already doing to serve as a resource of ideas that may be new to some. Let us work toward the same goal: to free the learning potential and creative expression of each student.

Definition of Human Intelligence

Dr. Howard Gardner, Co-Director of Project Zero and Professor of Education at Harvard University, has for many years conducted research on the development of human cognitive capacities. He has broken from the common tradition of intelligence theory, which adheres to two fundamental assumptions: that human cognition is unitary and those individuals can be adequately described as having a single, quantifiable intelligence. (Campbell, 1996).

In his study of human capacities, Gardner established criteria by which to measure whether a talent was actually intelligence. Each intelligence must have a developmental feature, be observable in special populations such as prodigies, provide some evidence of localization in the brain, and support a symbolic or notational system.

While most people possess the full spectrum of intelligences, each individual reveals distinctive cognitive features. We possess varying amounts of the seven intelligences and combine and use them in highly personal ways. Restricting educational programs to focusing on a preponderance of linguistic

and mathematical intelligence's minimizes the importance of other forms of knowing. Thus many students who fail to demonstrate the traditional academic intelligences are held in low esteem and their strengths may remain unrealized and lost to both the school and society at large.

Not only did Gardner's research reveal a wider family of human intelligences than previously believed, but he also generated a refreshingly pragmatic definition of the concept of intelligence. Instead of viewing human "smartness" in terms of a score on a standardized test, Gardner defines intelligence as:

- The ability to solve problems that one encounters in real life.
- The ability to generate new problems to solve.
- The ability to make something or offer a service that is valued within one's culture.

In his 1983 book, "Frames of Mind", Gardner presented his Theory of Multiple Intelligence that reinforces his cross-cultural perspective of human cognition. The intelligence is languages that all people speak and are influenced, in part, by the culture into which one is born. They are tools for learning, problem solving, and creating that all human beings can use.

A Description of the Seven Intelligences:

- Verbal – Linguistic intelligence consists of the ability to think in words and to use language to express and appreciate complex meanings. Authors, poets, journalists, speakers, and newscasters exhibit high degrees of linguistic intelligence.
- Logical – Mathematical intelligence makes it possible to calculate, qualify, consider proportions and hypotheses, and carry out complex mathematical operations. Scientists, mathematicians, accountants, engineers, and computer programmers all demonstrate strong logical-mathematical intelligence.
- Visual-Spatial Intelligence instills the capacity to think in three-dimensional ways as do sailors, pilots sculptors, and architects. It enables one to perceive external and internal imaginary to recreate, transform, or modify images, to navigate one self and objects through space, and to produce or decode graphic information.
- Bodily-Kinesthetic intelligence enables one to manipulate objects and fine-tune physical skills. It is evident in athletics, dancers, surgeons, and craftspeople. In Western societies, physical skills are not highly valued as cognitive ones, and yet elsewhere the ability to use one's body is a necessity for survival as well as an important feature of many prestigious roles.
- Musical Intelligence is evident in individuals who possess sensitivity to pitch, melody, rhythm, and tone. Those demonstrating this intelligence include composers, conductors, musicians, critics, instrument makers, as well as sensitive listeners.
- Interpersonal Intelligence is capacity to understand and interact effectively with others. It is evident in successful teachers, social workers, actors or politicians. Just as Western culture has recently begun to recognize the connection between mind and body, so too has it to come to value the importance of proficiency in interpersonal behavior.
- Intrapersonal Intelligence refers to the ability to construct an accurate perception of oneself and to use such knowledge in planning and directing one's life. Some individuals with strong intrapersonal intelligence specialize as theologiams, psychologists, and philosophers.

Intelligence should not be limited to the ones already identified. However, these seven intelligence provide a far accurate picture of human capacities than do previous unitary theories. Contrary to the small range of abilities that many standard IQ tests measure; Gardner's theory offers an expanded image of what it means to be human. He also notes that each intelligence contains several sub-intelligences. For example, there are sub-intelligences within the domain of music that include playing music, singing, writing musical scores, conducting critiquing and appreciating music. Each of the six other intelligence has also encompass numerous components.

Another aspect of the Multiple Intelligences is that they may be conceptualized in three broad categories. Three of the seven-spatial, logical-mathematical, and bodily kinesthetic, may be viewed as "object-related" forms of intelligence. These capacities are controlled and shaped by the objects which individuals encounter in their environments. On the other hand the "object-free" intelligences, consisting of verbal-linguistic and musical, are not shaped by the physical world but are dependent upon language and musical systems. The third category consists of the "person-related" intelligences with intrapersonal intelligences reflecting powerful a set of counter balances. (Boggeman, 1996)

Each intelligence appears to have its own devel-

opmental sequence, emerging and blossoming at different times in life. Musical intelligence is the earliest form of human giftedness to emerge. Gardner suggest that excelling at music as a child maybe conditioned by the fact that this intelligence is not contingent upon accruing life experience. On the other hand, the personal intelligences require extensive interaction with and feedback from others before becoming well developed (Gardner, 1995)

Gardner believes that since each intelligence can be used for good or ill purposes all seven are inherently value-free. Gandhi both had strong interpersonal intelligence but applied it in dramatically different ways. How an individual goes about using his intelligence within society is a moral question of crucial importance.

It is evident that creatively can be expressed through all the intelligences. However, most people are creative within a specific domain. For example, although Einstein was gifted mathematically and scientifically he did not exhibit equal genius linguistically, kinesthetically, or interpersonally. Most people appear to excel within one or two intelligences. (Gardner, 1993)

As teachers, let us create open systems of education to make it possible for the human mind – which can be the most open of systems – to flourish. Not all human beings will become great artist, or musicians, writers, but every human life will be enriched through developing many kinds of intelligence to the greatest extent possible, when individuals have opportunities to learn through their strengths, unexpected and positive cognitive, emotional, social, and even physical changes will appear.

With the global emerging village, ours now is a world for global citizens, a world of multiple intelligences both individually unique and mutually reinforcing. We must then prepare our students to become masters, not to other persons, but of themselves and their own destinies. We must keep and help them appreciate the creative dynamics between personal fulfillment and social responsibility.

We must make our students national citizens – intelligent, competent, confident, creative, responsible, appreciate of their native culture and history. And yet, we must make our students global citizens: competitive and productive, forward looking and pioneering. (Tenedero, 1998). This is a huge task and it begins with education, at home, in school, and is in the community.

Towards this end, everyone concerned-parents, guardians, teachers, school officials, researchers, psychologists, law makers and policy-makers, government and public educational institutions – must pour concerted, conscious and continuing efforts into a review and reformulation of the educational system. We must breakdown the walls of ignorance, myth and complacency and in their place build bridges of new knowledge and new methodologies, new ways of thinking, doing and being.

Quality education is the bridge we must build for our students. Making use of their multiple intelligences, they will be able to cross over this bridge successfully into the new century, into the empires of the future. Let this be our task today, our project, our dream, and our lasting heritage to our students.

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PROFILE OF CENTRAL PHILIPPINE UNIVERSITY

Central Philippine University is a non-stock, non-profit Christian institution where a well rounded program of education is offered under influences that strengthen faith, build up character and promote scholarship and research. Its motto is "Scientia et Fides" or Science and Faith.

Central Philippine University was founded by American Baptist missionaries as the Jaro Industrial School in 1905. It started as an elementary school where students work for their tuition and board. Growing steadily, it became a college in 1923 and a university in 1953.

Located on a beautiful twenty-four hectare campus, CPU has an atmosphere conducive to study and reflection. There are more than thirty buildings used for classrooms, offices, dormitories and other support facilities.

CPU offers courses and undertakes researches that support national objectives and answer regional and national needs. Research institutes were established to strengthen the research capabilities of the University. These include the Social Science Research Institute (SSRI), the Western Visayas Small Business Institute (WVSBI) and the Businessman's Information Center (BIC). WVBI and BIC were established cooperation with the Department of Trade and Industry. CPU is also a member of the Western Visayas Agriculture and Resources Research Development Consortium (WESVARRDEC). The CPU-Affiliated Non-Conventional Energy Center was established in 1989 to serve as the extension arm of the Department of Energy in Western Visayas.

CPU is a member of several national and international organizations among which are the Association of Christian Schools and Colleges (ACSC) and the Association of Christian Universities and Colleges in Asia (ACUCA).

CPU COLLEGE OF ENGINEERING

The CPU College of Engineering offers complete 5-year programs for the following disciplines: Chemical Engineering, Civil Engineering, Electronics and Communications Engineering, Electrical Engineering, Mechanical Engineering, and Master of Engineering.

In 1977, the college was chosen as one of the ten resource-base schools of engineering in the country by the Educational Development Projects Implementing Task Force (EDPITAF). The succeeding years saw the establishment of the Center for Civil Engineering Education (CCEE) in 1985 and the CPU-Affiliated Non-Conventional Energy Center (CPU-ANEC) in 1989. CCEE is an equipment fabrication project which received a grant from the United Board for Christian High Education in Asia while the CPU-ANEC which is being managed by the College is a joint project of CPU and the Department of Energy. In 1995, the College was cited by the Department of Science and Technology as the Engineering and Science Education Project (ESEP) School for Panay.

The College of Engineering dreams of reaching out to more students and providing them quality education with a distinct brand of academic excellence founded on scientific and Christian principles.

As the College celebrates its sixtieth anniversary this year, the maiden issue of the Engineering Journal is published to inspire both the faculty and the students to take a bolder step towards the world of research. It is hoped that the publication of the Engineering Journal would pave a way to more extensive engineering research work in the years ahead.

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