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Articles

Music Politics in the Process of Founding Turkish Nationalism.....	3
<i>Burcu Yıldız.....</i>	<i>3</i>
Behaviour Disorders in Nigerian Children with Language Impairments.....	11
<i>Helen Nwanze (Ph.D).....</i>	<i>11</i>
Effective Teaching and Learning of English in Nigeria in the 21st Century: Problems and Prospects.....	20
<i>Richard C. Ihejirika, Ph.D.....</i>	<i>20</i>
Religious Ethics and Leadership: Challenges for our Contemporary Society	28
<i>S. Awoniyi [Ph D].....</i>	<i>28</i>
Students' Reflections: A Case Study on Problem-Based Learning Approach in Malaysia	37
<i>Fauziah Sulaiman.....</i>	<i>37</i>
Effects of Aluminium Chloride Exposure on the Histology of Skin of Wistar Rats .	49
<i>Buraimoh Adebayo Adekunle.....</i>	<i>49</i>
<i>Ojo Samuel Adeniyi.....</i>	<i>49</i>
An Examination into Relationship between Moral Judgment Competence and Psychological Symptoms of Post-Graduate Students.....	64
<i>Nihan Çitemel.....</i>	<i>64</i>
<i>Mustafa Koç.....</i>	<i>64</i>

Enlightened self interest and philanthropic activities by private firms.....	75
<i>Shuhei Shiozawa</i>	75
Developing TVET Teachers for Meeting the Demands of Sustainable Development on Curriculum Tasks	87
<i>Prof. Lilian-Rita I Akudolu. (Phd)</i>	87
<i>Eyiuche Ifeoma Olibie (Phd)</i>	87
Soil Lead Composition and Distribution along Zaria – Sokoto Highway in Northern Nigeria	99
<i>Onoja, M.A.</i>	99
<i>Ibeanu, I.G.E.</i>	99
<i>Mallam, S.P.</i>	99
<i>Akpa, T.C.</i>	99
Task Allocation and Skilled Worker Scheduling with Genetic Algorithm to Minimize Total Tardiness.....	109
<i>Alper Türkyılmaz</i>	109
<i>Serol Bulkan</i>	109

Music Politics in the Process of Founding Turkish Nationalism

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Abstract

Music policies in the republican era were implemented parallel to the culture policies put into action during the construction of the nation-state in Turkey. In this article, the first issue is the ideal of synthesis-based musical aesthetic, which was developed under the effect of Westernization, during the creation of a modern nation-state in Turkey. Then, I discuss the folk song collection procedures practiced in the nationalization period; the purification strategies imposed on the lyrics of folk songs, the Turkification of non-Turkish lyrics and the assimilation practices. Lastly, I focus on the creation of a national music pursuant to the Turkism ideology and also on the musical reflections of the ‘competitive’ nationalist language created in the aforementioned period.

Keywords: Turkey, Music, Politics, Nationalism

Westernization Process and the Idea of Synthesis

The cultural policy implemented for the construction of a nation state during the foundation period of the Republic of Turkey, is a compulsory East&West synthesis project that aimed to create a national culture under a single identity. Identified with the Ottoman history and all non-Turkish elements, the East became the cultural taboo of the new nation-state. On the one hand, the Turkish History Thesis took the West as a model and defined a modernization ideal, which included Western-based concepts. On the other hand, it emphasized the importance of preserving the characteristics of local culture and attempted to establish an ethnical and historical connection between Turkish-ness and the origins of the concepts attributed to civilization. As also stated by Kadiođlu (1996), one of the most important paradoxes of the Turkish nationalism was its style, which imitated the West, but at the same time saw it as an enemy. According to Gökalp, a leading intellectual from that period, the future of the new civilization would be the synthesis of the modern civilization level –the West– and the traditional culture of the Turkish people; and this synthesis would define the Turkish culture:

We all understood that the oriental music is not only sick, but also irrelevant to our nation. Our folk music is the product of our national culture, and the Western music is the product of our new civilization; so they are not foreign for us. Under those circumstances, our national music will be born from the synthesis of the folk music in our country the western music. Our folk music has provided us with a lot of melodies. If we collect these melodies and harmonize them according to the western music system, we will have a music which not only national but also European. Turkism's plan in the field of music consists of this in essence, and the rest depends on the discretion of musicians and music lovers (Gökalp 1972: 146-147).

This was an attempt to transform a reinvented folk culture into “national high culture”. If we look at this formulation’s reflections in the music policies of republican period, we will see that this process is the continuation of the Westernization movements observed in the Ottoman Empire era. Musical changes which started during the first half of the 19th century especially at the Ottoman Empire’s army can be accepted as developments which laid the foundation of the national music aimed in the republican era. These developments in the Ottoman era included: replacing the old janissary band known as *mehteran* with European style military bands which played anthems and marches in the *Nizam-ı Cedid* corps; commissioning the Italian musician Guisepe Donizetti to arrange the transition to the Western music system, especially in musical notation; establishing *Mızıka-yı Hümayun* (Imperial Military Music School); composition of the first opera of the Ottoman Empire by Çuhacıyan; studies carried out by Rauf Yekta to make Turkish music polyphonic (Hasgöl 1996; Balkılıç 2009)

It was planned that, polyphony would be applied on a large scale to the national music formed out of the synthesis of folk music –the national culture– and the western music, and this application would constitute a model. However, the non-national oriental music, which reminded the Byzantine and Greek elements in the history, must have been eliminated before this attempt. Therefore, the *tekkes* and *zawiyahs* (dervish lodges or Sufi convents) were banned in 1925 to make sure that there remained no locational and institutional possibilities for the reproduction of Classical Turkish Music. In 1926, the oriental music department of *Darülelhan* (Istanbul Conservatory of Music) was closed. Then broadcasting Classical Turkish Music on the radio was banned for nearly 20 months in 1934. In 1935, the Presidential Symphony Orchestra of the Republic of Turkey was established and the State Conservatory was founded in 1936. Western-based reforms implemented to popularize polyphonic Western music

included: playing western music in public spaces, for example to the passengers on ferries; organizing free concerts and opening music courses at community centers (*Halk Evleri*); founding conservatories; sending talented musicians abroad for training; collecting, transcribing and categorizing popular Anatolian folk songs and re-arranging them to be polyphonic; establishing a new radio channel which broadcasted western classical music, jazz music and western pop music. These reforms summarize the spirit of the period.

The Turkish culture was adopted as the national culture for the creation of a national music shaped under the influence of Turkism ideology. The music of the other ethnic communities in Anatolia was either ignored or assimilated to be attributed to Turkish folk music. In order to define a pure and unspoilt Turkish culture pursuant to the Turkish History Thesis and the Sun Language Theory, the pentatonic scale was attributed to the Turkish nation and the origin of Turkish music was claimed to be Central Asia (Stokes 1998: 85). Adnan Saygun (1996) announced this hypothesis to the world using statements like “Pentatonism is Turkish people’s signature on music” or “Wherever you hear a pentatonic scale, the people living there are Turkish” (as cited by Şenel, 1999: 112).

Şenel determined that folk music studies which developed especially in the field of folk music collections in Turkey, actually started with a survey conducted on music teachers and other related people in 1922. Some of the questions posed in the survey were: “Are there any musicians or famous instrumentalists in your home town?”, “Is there any music society in the city you live?”, “Can you tell us the popular folk songs of your town and village?”, “Which folk songs are the most popular?”. The participants of the survey were also requested to notate these folk songs and send the notations to related people. This survey continued for three years and the first collection studies started in 1925, in Western Anatolia. These collection studies were not deemed successful as no voice recorders were used and as the oral dictation method posed a high risk of mis-notation (Şenel 1999: 106-107). The phonograph was brought to Turkey in 1926 and following this development, four different expeditions were organized to Anatolia from 1926 to 1929 to collect folk songs. As a result of these expeditions, 670 folk songs were collected and published in twelve volumes. Music reformers of the period found these expeditions fruitless. During the 1930s, *Ankara Halkevi* (Ankara People’s House) invited the Hungarian composer and ethnomusicologist Bela Bartok to Turkey, to provide the researchers of the period with the guidance of an expert experienced in the fields of folk song collection and field research. Bela Bartok, a composer of ‘modern Hungarian music’ who had his roots in folk music, was thought to be a potential source of inspiration for young Turkish musicians. *Darüelhan*’s transformation to Istanbul Conservatory of Music (1928) and the establishment of Ankara State Conservatory (1936), fortified the institutional structure of national music. Expeditions that started in 1937 and lasted for 17 years resulted in the collection of approximately 9,000 folk songs and enabled the formation of a national folk music repertoire (Şenel 1999: 113-114).

Reflections of the Turkification Policy Through Folk Songs

The People’s House was one of the institutions that had an effective role in the popularization of national music in the republican era. These community centers organized various concerts and special performances, provided musical training to local people and carried out folk song collection studies (Hasgül 1996: 42). After the 1940s, with the spread of radio throughout Turkey, these recently collected folk songs were performed by a chorus and broadcast on a radio program called *Yurttan Sesler* (Sounds of the Motherland), thus becoming widely disseminated. However the performance principles adopted by the *Yurttan Sesler* chorus resulted in the development of a new performance method that was alien to the local culture.

This method disregarded personal styles of expression in folk music; and centered on accompaniment and chorus performances that did not actually exist in the Anatolian tradition. Even though orchestra conductors had never been a part of the tradition either, and this practice was almost impractical for Anatolian folk songs, conductors were appointed to direct the *Yurttan Sesler* chorus; and the traditional *aşık tavrı* (minstrel style) was ignored (Tekelioğlu 1999: 149). According to Stokes, Turkification of the folk songs in the national repertoire (replacing the foreign words with pure Turkish words) at times led to really absurd results. He explains his claim with the following example:

A folk song which begins with the lyrics 'Prahoda mindim sürdüm seyran' was included into the TRT (Turkish Radio and Television Corporation) repertoire, but with different lyrics: 'Gemilere bindim sürdüm Samsun'a'. The Russian word 'prahod' (meaning 'train') was not acceptable in a 'national' folk song, and a pure Turkish word which meant 'train' was not available, so 'prahod' was replaced with the Turkish word 'gemi' (meaning 'ship'). Consequently, the 'train trip' was turned into a 'cruise'. Taking the Arabic origin of the word 'seyran' into account, the high-principled collectors replaced it with Samsun (a city on the northern coast of Turkey) and changed the destination of the trip from Baku to Iğdır (a city in eastern Anatolia). The cruise we end up with in the end, does not seem to be much rational. (Stokes 1998: 104)

The attempt aimed at creating a national identity and culture in the early days of the republic was the language reform implemented during 1930s. In many respects, this was an extension of the Turkish History Thesis. In this period, the first goal of the language reform was to eliminate language differences and create a national language. The second goal was to 'purify the language' through minimizing the Ottoman effect on the language and excluding foreign words (Cagaptay 2006: 54-55). According to Sun Language Theory, all human languages throughout the world are descendants of the Turkic language. This theory argues that Turkic language was the first language in human history and it was born as a result of the sun salute rituals of the people (Balkılıç 2009: 45). These hypotheses were not based upon empirical evidences and consequently they were put aside after 1938. However, this does not mean that the language reform was totally abandoned. The efforts to find pure Turkish words and to base these words upon Central Asia was over; although the attempts to clear some words used by the people of dialects and to use a standard and pure written language continued. If a folk song with lyrics not fitting into pure Turkish language was discovered in the folk music collection studies, these non-Turkish words were eliminated or replaced with pure Turkish ones, as part of this language reform. Moreover, the language of certain minorities or localities was totally ignored in these collection studies, for the sake of creating a standard language (Balkılıç 2009: 46).

While the Turkish History Thesis had asserted that the Turkish language was a key to both Turkish ethnicity and nationality, 'Citizen! Speak Turkish' campaign and 'Surname Law' kept the avenues of assimilation open to those who were not ethnically Turkish (Cagaptay 2006: 63). The Turkification policy aimed to combine Muslims and non-Muslims coming from different ethnic origins but living in the Republic of Turkey, in a single melting pot – the Turkish national identity – and then to recreate them as Turkish citizens. As Rıfat Bali cited, the 'Citizen! Speak Turkish' campaign started on January 13, 1928, pursuant to Istanbul University Faculty of Law Student Council's the decision taken at the council's annual convention. The president of the student council made a suggestion to prohibit minorities from speaking languages other than Turkish in public spaces (avenues, streets, ferries, cafes and

recreation venues like cinemas and theatres) especially in Istanbul. Then at another meeting held in Turkish Hearths office, participants decided to organize conferences at schools on this matter and to hang posters and banners saying ‘Citizen! Speak Turkish’ to various locations. This campaign led to public harassment of many citizens (Bali 2000: vi-vii). Even though this national language campaign seems to target especially the non-Muslim population, it also targeted Muslim citizens whose native tongue was not Turkish; namely the Arabs, Circassians, Cretan Muslims and Kurds. However, the campaign is known to be persistent and thus effective especially about the assimilation of the Jews in Turkey (Cagaptay 2000; Bali 1998; Bali 2000). The following decisions taken under the heavy social pressure of the era by a commission formed by the Jews in Edirne and the synagogues’ encouraging approval of these decisions reveals the extent of this oppression:

1- Turkish language will be spoken in every kind of gathering places. 2- At religious ceremonies and rituals, the rabbis will recommend the people to speak Turkish. 3- Girls and boys attending Jewish schools must speak Turkish at school and also in public places and their houses. 4- Merchants and tradespeople in Edirne will sign an agreement stating that they will speak Turkish. 5- At cafes and nightclubs frequented and run by the Jews, waiters/waitresses speak Turkish with the customers (Bali 1998: 217).

Another Turkification strategy was to Turkify names and surnames according to the Surname Law¹ enacted in 1934, which required everybody to take a family name. Cagaptay indicates that “since most Turks already had last names, the intent of this law was not to give new last names to the entire population. Rather, the act aimed to force the citizens to have their last names recorded, so that they could be screened for Turkish-ness” (2006: 62). If the names did not sound Turkish such as the names ending with ‘yan, of, ef, vich, is, dis, pulos, aki, zade, mahdumu, veled, and bin’, citizens could not be registered. Than this made it impossible to register Armenian, Bulgarian, Macedonian, Bosnian, Serbian, Greek, Cretan, Persian, Georgian or Arabic last names. So people had to change their names. The Republic of Turkey attempted to assimilate minorities by forcing them to adopt the Turkish language and even to change their names. As a result, a new definition, which can be called “nation-through-language”, became possible and the country’s demographic diversity seemed to be bound to clash (Cagaptay 2006: 64).

National or Nationalist Musical Aesthetics?

Besides, there are many cases in which the rhythm and melody of the folk songs were changed and Kurdish, Laz, Greek and Armenian lyrics were Turkified in the collection and transcription phases and then added to the national repertoire. In addition to these purification and Turkification strategies practiced on the lyrics of folk songs, non-Turkish ethnical components were disregarded, when it was not possible to assimilate them. For instance, the TRT archive closed its doors to the Greek repertoire in the Eastern Black Sea Region and the Kurdish repertoire in Southeast Anatolia (Hasgöl 1996: 43). Another strategy was ignoring and attributing to Turkish culture, if possible. *In an article Fuat Köprülü wrote in 1922 Türk Edebiyatının Ermeni Edebiyatı Üzerindeki Te’sirâtı (Turkish Literature’s Influence on Armenian Literature), he could not neglect Armenian literature but instead claimed that it was nothing different from the Turkish minstrel literature, one of the oldest Turkish traditions:*

The evolution stages (...) of the Turkish Minstrel (Aşık) Literature has been explicitly revealed and it is obvious that the Turkish Minstrel Literature, with

¹ for further information see Meltem F. Türköz, 2004.

pure Turkish works of art dating back to the pre-Islamic era, has never been under Armenian or Christian influence. Moreover, the works of Armenian Minstrels (Aşug) writing in Turkish, are all written with a Turkish taste and inspiration... Even the name (Aşug) and musical instrument of the Armenian Minstrels are taken from Turks... Armenians had to adopt the Turkish culture, as Turks were not only numerically and politically dominant, but also further advanced in civilization than the Armenians.” (Köprülü 1986 (1922): 268)

In his article *Memleketimiz Halk Şarkıları* (Folk Songs of Our Homeland) included in his book titled *Anadolu Türküleri ve Musiki İnkılabımız* (Anatolian Folk Songs and Our Music Reform), Mahmut Ragıp Gazimihal, one of the leading figures of the music policies and folk music studies implemented in the Early Republican Period, categorizes the folk songs of the Asia Minor into two classes: (i) “Genuine Turkish folk songs with Turkish lyrics” and (ii) “Folk songs with lyrics in minority languages” (Gazimihal 2006 (1928): 55). According to Gazimihal, the most characteristic minority folk songs were the Greek and Kurdish folk songs which “bore no resemblance to Turkish folk songs”. Other folk songs that bore resemblance were actually inspired by Turkish folk songs. When Greek folk songs are analyzed from a Turkish perspective, for example Greek folk songs collected on the Mediterranean coast do not have any connection with the Turkish folk songs in the same region. Gazimihal claimed that folk songs comparable to Kurdish folk songs could be found in Syria, Iraq and Iran. Quoting a long passage from the ‘Turkish Music’ chapter of *Encyclopedie de la Musique*² written by a board directed by Albert Lavignac, he sardonically stated that Kurdish music could not have anything to do with Turkish folk songs. The writer of the quoted passage stated that the Kurdish workmen in Istanbul played the *zurna* (a kind of horn) in a really inadequate manner and that the music of every community could only be evaluated by their own intellectual level:

The sound of this zurna is intolerably shrill and discordant. In Istanbul, in the neighborhoods where the members of Kurdish families live, there are certain kahves (a kind of local coffeehouse) frequented by these workers. Many a time, I had the opportunity to pass by these coffeehouses and listen to their dance music played during festivals with davul (a large, double-headed drum) and this kind of zurna. Even though I tried my best, I did not hear even a single faultless melody or a faultless fourth or fifth note. I was astounded to see these people dancing for hours to this faultful music. In any case, I have to believe that they take pleasure in this kind of music. As a result, we can conclude that the music of a community reflects its intellectual level. (Gazimihal 2006 (1928): 57)

Gazimihal continued his article by claiming “there wasn’t any example of a real Armenian tune in Anatolia”. According to him, “the Armenians of Anatolia do not know any language but Turkish and they do not have any music apart from Turkish songs. The music of the Armenians in the Caucasian territory, on the other hand, has some special characteristics, however, these characteristics have come out of Turkish music” (2006 (1928): 57).

Bohlman points out that the crucial argument advanced by modernist rhetoric of national aesthetics was “our music is better than anyone else’s”. This assertion was then followed by “our nation is better than anyone else’s”. Bohlman differentiates between the ‘national’ and ‘nationalist’ discourses, stating: “By claiming that ‘our music is better than anyone else’s’, the aesthetic rhetoric that accompanied the rise of the modern nation-state also underwent a dramatic shift from emphasis on the national, to the assertion of the nationalist.

² Even though Gazimihal did not state in his book, this part of the encyclopedia was written by Rauf Yekta.

Comparison was crucial to that shift, and competition was critical to its implications” (2004: 117-118). As a common character of nationalism, the folk and the ‘authentic tradition’ were redefined through folklore, music and history in Turkish case. In that context, I discussed these discourses to reveal the competitive nationalist discourse of some leading intellectuals from the republican period and to review the music politics of that period.

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Behaviour Disorders in Nigerian Children with Language Impairments

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Abstract

Research documents some co-morbidity between language impairment (LI) and behaviour disorders. This study examines a group of Nigerian LI children for indications of this co-morbidity. Participants were 62 children with expressive language delays. Their mean age was 4 years 2 months. Their mean length of utterance was 1.9 morphemes. The ratio of boys to girls was 5:1 in favour of boys. Spontaneous speech samples were obtained from each child during an informal play session from which their MLU-ms were computed. Children exhibiting challenging behaviour were assessed using the DSM-IV checklist for ADHD or the Childhood autism rating scale (CARS). The results adduced that 54% of the children had attendant behaviour disorders, lending support to the existence of a universal LI behaviour-disorder sub-type. Most prevalent was ADHD which comprised 57% of the disorders. LI children with no behaviour disorder had the lowest MLU-ms in the study. The highest MLUs were found in children with ADHD. It was suggested that a multi-disciplinary approach be required to enhance the long term outcomes of this LI sub-group. Further research is indicated to better manage LI when co-morbid with behavioural or social challenges.

Key word: - Co-morbidity, language impairment, behaviour disorders, Nigeria.

Introduction

There are indications that for a sub-group of people with language impairment, challenging behaviour is sometimes co-morbid (Benner 2005; Durkin & Conti-Ramsden 2010 & St. Clair et al., 2011). Coster et al., (1999) located behaviour disorders in 48% of their sample with specific language impairment (SLI). They also underlined the absence of aggression in this group. A study by Fontenot et al., (2011) found that even amongst adolescences been managed for behaviour disorders most when tested, exhibited an underlying language impairment. Hollo (2012) reported similar results. McGrath et al., (2008) documented some co-morbidity between SLI and ADHD-I (the inattentive sub-type). Other studies have also located language impairment in some children with ADHD (Cohen et al., 2000; Jonsdottir et al., 2005; Ketelaars et al., 2010 & Redmond et al., 2011).

It has even been suggested by some that SLI may be on the same continuum with the autism spectrum disorder (ASD) albeit profiling a milder manifestation. Those authors averred that in some cases, an earlier diagnosis of SLI had to later be re-defined as ASD when the child was older (Whitehouse et al., 2009).

Some researchers have indicated different behavioural manifestations for different types of speech and language disorders. Ketelaars et al., (2010) found that children with pragmatic language impairments (PLI) affecting language use, were more likely to exhibit behaviour disorders than were children with structural language impairments of their syntax. Botting & Conti-Ramsden (2000) found that children with impairments in receptive language were more likely to have behaviour disorders than those with expressive language disorders. Behaviour disorders were located in children with a combination of SLI and phonological disorders but not in children with phonological disorders alone (McGrath et al., 2008). Hart et al., (2004) found a correlation between the severity of the expressive language impairment and pro-social behaviour. They also adduced a higher proportion of withdrawn behaviour in children with SLI than for those in the regular population. A survey of teachers suggests that behaviour disorders in SLI children tend to decrease with age (Redmond & Rice, 2002).

Research has also documented inadequate social skills in language impaired children. Stanton-Chapman et al., (2007) indicated that SLI sufferers were more likely to experience difficulties with their social skills than with behaviour disorders. This was corroborated by St. Clair et al., (2011) who in addition, averred that social skills difficulties increased with age. McCabe (2005) adduced that in the classroom, children with SLI appear to have particular difficulty with task orientation and assertiveness. Their *stress-tolerance* level was lower than that of non-impaired children and their social skills with peers were challenged. Problems have been documented with peer acceptance of children with SLI (Laws et al., 2012). The present study of Nigerian children with expressive language impairments, examines whether a sub-group with behaviour-disorder co-morbidity exists amongst them. Their spoken language skills are measured by their mean length of utterance in morphemes (MLU-m). This is a standard measure of syntactic complexity in child language (Brown 1973; Parker, 2005 & Rice, et al., 2010 & Ranalli, 2012). The childhood autism rating scale and the DSM-IV checklists are employed to detect behaviour disorders (Schopler, et al., 2010; American Psychiatric Association 1994).

Method

Participants

There were 62 children in the study. They ranged in age from 18 months to 12 years old. There were 49 boys and 13 girls. Each had a history of language delay. Their average age for the onset of speech was 24 months. Other motor developmental milestones within the first 18 months of life were achieved within normal limits. Children with a low profile of abilities for the achievement of non-linguistic milestones were eliminated from this study. Also eliminated were children who met the criteria on the CARS for the diagnosis of ASD. Prior to their referral for speech therapy, auditory brain-stem response audiometry had been conducted on each child. It revealed normal hearing in all the children. Each child was recruited incidentally and assessed on their first visit to the speech therapy clinic of the Lagos University Teaching Hospital, Lagos Nigeria. Their parents had expressed concern about delays in their spoken language.

Materials

1. A doll's house with a boy and girl doll.
2. A toy car with a slot in doll.
3. A toy plate, cup, cutlery and a water bottle, plastic food: - apple, banana, orange, bread, biscuit, chicken, egg, ice-cream, tomato, corn on the cob, a milk bottle and a juice packet.
4. A toy train, boat, bus and aeroplane.
5. Shape-sorter.
6. Stacking discs and/or a set of graduated cups.
7. A set of 12 flash cards each depicted a child performing one of the following actions: - standing, sitting, walking, eating, crying, sleeping, running, waving, crawling, hopping and talking.

Procedure

Speech assessment

A spontaneous speech sample was obtained informally from each child during a 2 hour play session. It was conducted by the researcher in a clinical setting in the presence of a parent. Information regarding each child's developmental history was obtained by a parent interview. The authenticity of the speech obtained during play was corroborated by the parent. A set of toys and flash cards were presented to each child. The investigator's comments ran as follows as she presented the items: - take/look at this or *what are you/is he or she doing?* The toys were presented in separate sets as listed above.

The mean length of utterance in morphemes (MLU-m) was computed for each child as instructed by Brown (1973).

Assessment of behavior

A. Assessment of ADHD

The DSM-IV checklist was completed for children who appeared restless or inattentive. The children placed in the ADHD category were those who met the DSM-IV criteria for ADHD-i (inattentive sub-type) or ADHD-h (hyperactive sub-type). The test requirements are

that the child meets 6 out of 7 features on the DSM-IV list for that sub-type. They require that the behaviour must have persisted for a minimum of 6 months or longer.

B. Assessment of withdrawn behaviour

The childhood autism rating scale (CARS) was completed by parents and therapists for children who appeared unusually shy or withdrawn. Children assigned to the *withdrawn* category were those who did not meet the criteria for a diagnosis of an ASD but obtained a score of 2 on question 1, on the CARS inventory i.e. **relating to people- Mildly abnormal relationships-** (the child might avoid looking at adult in the eye; avoids the adult or become fussy if interaction is forced; be excessively shy not be as responsive to the adult; or cling to parents somewhat more than most children of the same age). Children who met the CARS criteria for a diagnosis of ASD were eliminated from this study.

C. Assessment of oppositional behaviour

Children placed in this category were those observed by parents and the researcher to routinely resist instruction, insisting on doing *their own thing* this, behavior sometimes escalated into tantrums. Children with no apparent behaviour challenges were placed in the *none* category.

Results

The results adduced that 56% of the children had challenging behaviours and 44% had none. The percentage of children falling into each behavioural category are displayed in table 1.

Table 1: Distribution of Challenging Behaviour

CASE	NUMBER	PERCENTAGE (%)
ADHD-H	15	24
Withdrawn	13	20
Oppositional	7	11
ADHD-I	5	8
None	27	43

The largest group was the ADHD-h category. They comprised 57% of the behaviour disorders. Children with ADHD-i were the fewest.

Table 2: Mean ages and MLU-ms of children

CASE	AGES	SD	MLU	SD
Total sample	4.2	1.9	1.9	1.35
ADHD-H	4.45	1.4	2.34	1.7
Withdrawn	4.5	1.3	2.47	1.2
Oppositional	3.8	1.5	2.07	1.2
ADHD-I	3.6	1.1	3.26	1.9
None	3.9	2.6	1.31	1.2

Table 2 shows the mean ages and MLU-ms of the children in each category. Pearson correlations between age and MLU-ms for the total sample and within the various groups were

all insignificant. The mean age of the total sample was 4 years 2 months with a standard deviation of 1 year 11 months and a range of 1.5 to 12 years. Their mean MLU-m was 1.9 morphemes with a standard deviation of 1.35 morphemes. The range was from 0 to 6.4 morphemes. Children who displayed a form of challenging behaviour had significantly higher MLU-ms than did those with no behavioural challenges ($t= 3.1$; $P < 0.003$). The children in the ADHD-h category were the oldest in the study. The youngest were children with oppositional behaviour. The highest MLU-ms were obtained by children in the ADHD-i group at 3.26 morphemes. When the Walsh test was applied, it was significantly higher than that in the total population ($P < 0.03$). The ratio of boys to girls is 5:1 in favour of boys. The girls were slightly but not significantly younger than were the boys. Their MLU-m was 0.35 morphemes longer than was that of the boys. This difference was statistically insignificant.

Discussion

The expressive language of the children in this study as measured by MLU-m was significantly delayed for their age. With a mean age of just over 4 years old, their average MLU-m was only 1.9 morphemes. This is recorded in the literature for 2 year olds. By age 4, an MLU-m of 4.4 morphemes is expected from a neuro-typical child (Otto, 2002). The children in this study were evaluated prior to language intervention. Language therapy is likely to enhance their spoken language skills. Age and MLU were not correlated in this sample, indicating that biological maturation had little effect on their speech production. The literature reports a significantly lower MLU for SLI boys than for girls (Ranalli, 2012). In the present sample, the MLU-ms of the girls were not significantly longer than that of for boys. At 5:1, the distribution of boys to girls in this study is higher than that reported by Ketelaars (2010) who quoted 2.6:1 in favour of boys. The present results suggest co-morbidity between LI and behaviour disorders in 54% of the sample. This is higher than the 48% reported by Coster et al., (1999). Two of the children displayed a combination of behaviour disorders. More than half of the children with behaviour disorders exhibited a form of ADHD, most reflecting ADHD-h. The highest MLU-ms in the study were found in children with ADHD particularly the inattentive sub-type. Both ADHD groups had MLU-ms which were higher than those for children with no behaviour disorder. There is some similarity between these findings and those reported by Redmond (2004) who also found the children with ADHD to have higher MLUs than all the other language impaired groups. The fact that the LI children with behaviour disorders sported significantly higher MLUs than did those without behaviour disorders, supports the argument for co-morbidity. Had frustration arising from limited communication skills been the trigger for behaviour disorders, the lower MLU-m children would have exhibited more behaviour disorders than did the higher MLU-m children. The contrary was adduced.

Cohen et al., (2000) also reported that the most frequently diagnosed behaviour disorder in children with LI is ADHD. Additionally, they cautioned that some challenges attributed to ADHD may actually be features of SLI rather than that of the ADHD disorder. Jonsdottir et al., (2005) underlined the need to screen ADHD sufferers for underlying language impairments. McGrath et al., (2008) expressed surprise that higher numbers of SLI children had ADHD-i than did other LI sub-groups examined in their study. Ketelaars et al., (2010) suggested that the early detection and management of pragmatic language Impairments (PLI) may assist with the early detection of ADHD and ASD as PLI is highly correlated with these.

There are indications that following language intervention, behaviour disorders in LI sufferers may reduce (Deal, 2009). Should this not occur, there may be a need for speech and

language pathologists to interact with behaviour therapists to further enhance the outcomes of these children. Research implies that whilst behaviour disorders may reduce with age in SLI children, social problems may increase (St. Clair et al., 2011). A longitudinal study tracked groups of children with SLI and PLI into adulthood. It found that the SLI groups were limited to employment which did not require high amounts of language skills. The PLI group did better. They achieved higher academic attainments than the SLI group and functioned in employment which requires higher skills. In adulthood, both groups remained challenged in the arena of social skills (Whitehouse et al., 2009). Their results buttress the need for a long term multidisciplinary approach to the management of LI sufferers to enhance their optimal outcomes in adulthood. Ketelaars (2010) noting a high correlation between PLI, SLI and the occurrence of behaviour disorders, also encouraged such an approach.

The cross-sectional design of this study and its small sample size limits the scope to which these results may be interpreted. The findings do however lend support to the universal existence of an LI sub-group with attendant behaviour disorders. Further research is required to shed more light on the LI sub-types in Nigeria, their behavioural and social challenges and their long term outcomes.

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Effective Teaching and Learning of English in Nigeria in the 21st Century: Problems and Prospects

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Abstract

It is an indisputable fact that English Language plays indispensable roles in the linguistic set up of Nigeria, especially in the areas of education, official transaction, and social interaction. And from the prevailing circumstances, there is no indication that the prestigious status and the role of English in Nigeria would be overturned for a long time to come. However, the emergence of the 21st Century with its attendant challenges seems to be seriously threatening effective teaching and learning of English in our schools and colleges. The adverse consequences of the threat is beginning to manifest as can be noticed in the poor performance of candidates in English in public examinations such as the West African Senior School Certificate Examinations (WASSCE) and related exams. In a determined effort to address this anomaly, which has the capacity of vitiating the standard of education in Nigeria and stalling other related developmental strides, this paper identified and critically examined the factors that are seriously threatening effective teaching and learning of English in Nigeria in this millennium. The paper further suggested ways of addressing the identified problems in order to reposition the teaching and learning of English in Nigeria in order to achieve the desired result.

Keywords: effective, teaching, learning, English, problems and prospects

1. Introduction

From all indications, it could be argued that English Language is a legacy bequeathed to Nigeria by the colonial masters, who came to Nigeria either as political administrators, missionaries or traders during the colonial era. It is a legacy in the sense that the existence of the language in Nigeria since the period of colonialism and post-colonialism has impacted positively on Nigeria, especially in the areas of education, official transaction and social interaction. The acquisition of formal education in Nigeria has been made possible by the existence of English. As language for education, it is the language of classroom instruction from later primary school to tertiary education. Textbooks other than the ones written in local languages are written in English. Above all, examinations at all levels of education are conducted in English. Official transactions, especially in offices and other official settings, are mainly conducted in English. English is also predominantly the language of law, politics and mass media in Nigeria. The gulf between the multi-ethnic nationalities in Nigeria would have been manifold if English had not existed in Nigeria. Against this background, English becomes a critical language, which plays an indispensable role in the educational, social, political, economic and technological advancement of Nigeria. Therefore, even as Nigeria clamours for the vision 20-20-20, one of the critical areas that deserve attention is language (especially English) development.

If English must be developed in Nigeria to be able to play the expected role in the appropriate sectors, it must be effectively taught and learnt in our schools and colleges. But from the prevailing circumstances, some challenges of the 21st Century seem to be seriously threatening effective teaching and learning of English in our schools and colleges. Today, the consequences of the threat is beginning to manifest as can be noticed in the poor performance of candidates in English in public examinations such as the West African Senior School Certificate Examinations and related exams. For instance, Dr Iyi Uwadiae in his media briefing on Thursday, December 23, 2010 on the release of November/December 2010 West African Senior School Certificate Examinations (WASSCE) stated that out of a total of 133,507 candidates that sat for the English examination, only 43.06% passed. The situation is not better at the tertiary institutions. One of the greatest challenges facing lecturers at that level is the inability of a good number of the students to communicate effectively in English. Consequently, while parents and the general public are lamenting, employers of labour have devised a way of separating the chaff from the grain in the labour market. Today, employers go extra mile to conduct aptitude test for applicants before they decide who to employ. In the end only few are usually found employable while the rest are thrown back to the labour market thereby increasing the unemployment rate.

It is therefore our aim in this paper to critically examine the factors that are seriously threatening effective teaching and learning of English in this millennium and further suggest ways of drastically addressing the identified problems in order to reposition the teaching and learning of English in Nigeria in order to achieve the desired result.

2. Factors Threatening Effective Teaching and Learning of English in Nigeria in the 21st Century

Expectedly, if the factors that naturally threaten effective teaching and learning of English in general were to be enumerated, they will not only be numerous but also diverse. However, given our purpose in this paper and the space available to us, we shall limit our discussion on only factors whose origins are traceable to the emergence of the 21st Century. Further discussions on the factors are as presented below.

2.1 Teacher Factor

The teacher is the principal actor in the teaching and learning processes. He controls and manipulates the other elements in the teaching and learning processes. Therefore, the failure of the teacher might entail the collapse of the entire processes. In this millennium, there are indications that point to the fact that there is teacher failure in the process of teaching and learning English at all levels of education. For instance, at the primary school level, the new policy stipulates that the minimum qualification for primary school teaching is Nigeria Certificate in Education (NCE). By this policy, the age long Teachers' Grade II Certificate (TC II) is abolished. But it should be recalled that the TC II curriculum was designed mainly to prepare teachers for primary education. By so doing, students were rigorously trained in all the primary school subjects including English. On graduation, the teachers were found to be competent and skilled in all the primary school subjects. Those who were found wanting in some subject areas were required to pass them before they were permitted to function as full-fledged teachers. Then the TC II teachers were required to teach all the primary school subjects including English in any primary class assigned to them, an assignment they carried out creditably because of the effective training they had.

With NCE as the minimum qualification for primary school teaching as the new policy, NCE holders who specialize in only one or two subjects, which may not include English, are now required to teach all the primary subjects including English in any class assigned to them. Experience has shown that such teachers in the primary schools are not professionally competent to effectively teach English. A case in point is the experience of the author as a resource person at the workshop organized by the National Teachers Institute (NTI), Kaduna for primary school teachers, which was held at Orlu Imo State between 21st August and 9th September, 2006. The revelation was startling. The author noticed to his chagrin that a good number of the teachers participating in the workshop lacked the basic knowledge of English to the extent that some could hardly differentiate between the parts of speech. The performance in English of the unsuspecting pupils who passed through such teachers is better imagined than described.

Going by the facts available, the situation at the secondary schools is not better. According to Jowitt (2009), "a number of persons teach English in Nigeria who have not undergone proper training or indeed any training for it" (p.14). The source further states that in some secondary schools, some graduates who have degrees in subjects barely related to English such as Mass Communication teach English, and for such teachers, the only guidance they receive for their English classroom practice comes from the syllabus, or from the student's textbook.

In this millennium, people are obsessed with status. Today, the profession one finds oneself in is his status symbol. Thus, the respect, privilege and attention one commands in the society depend to a large extent on the profession one keeps. While such professionals as engineers in oil companies, accountants, bankers, medical doctors, lawyers, etc are held in a very high esteem, such profession as teaching is looked down upon. Consequently, brilliant students tend to go in for those courses that would make them to land in prestigious professions, while courses leading to teaching are dumping grounds for those who cannot find their way to the prestigious professions.

2.2 Information and Communication Technology (ICT) Explosion

In this 21st Century, there is ICT explosion. The knowledge of computer and the availability of the internet services at every nook and cranny are features which distinguish this millennium from the previous one in Nigerian context. Although these developments have the

potentialities of enhancing effective teaching and learning of English, in reality they seem to be a source of distraction in third world countries like Nigeria. In Nigeria, for instance, it is common knowledge that many students spend their valuable time on the web in search of frivolities such as unnecessary chatting, viewing of blue film, internet fraud practices, games and so on at the expense of more valuable academic activities such as extensive reading which research findings have been found to be potent for effective learning of the target language. Before this century, students were in the habit of exchanging interesting and exciting novels they had read among themselves. But today what is in vogue among students is exchange of home video films that are rich in violent crimes and immorality.

Examining the effect of ICT on English in Nigeria, Egya (2009) posits that “there is a great injury being inflicted on the English Language with the explosion of the telecommunication in Nigeria today” (p.7). According to the source, the art of letter writing has almost collapsed, courtesy of GSM since young people write letters only if they have to apply for a job position, and you can be sure that such letters are riddled with basic errors. The author further laments that the appalling and embarrassing part of GSM language intrusion is that some students unconsciously bring short hands such as “sth” for something, “ppl” for people, “u” for you, b4 for before and many others into their official writing, such as examinations.

2.3 Wrong Models

The Behaviourist theory of language learning and acquisition maintains that language learning and acquisition is a process of habit formation and imitation. It is in recognition of this fact that Wilkins (1974) argues that when a child is adequately exposed to language, he will produce language himself, and what he produces is an imitation of what he has heard and this is a process which adults often try to stimulate. If the Behaviourist theory is anything to go by, learners of English in Nigeria in the contemporary times are seriously handicapped because they are constantly exposed to wrong models. Take for instance, the Nigerian music industry is currently replete with brands of music (local and foreign) which are rendered in all manners of sub-standard variety of English. These brands of music are everywhere: the street, the radio, the television, the night clubs, etc. Unfortunately, these brands of music excite the youths, who naturally respond by singing and dancing them. By so doing they imitate the wrong models which they unconsciously internalize in their subconscious as a result of practice.

It is also common knowledge that a good number of reading materials such as novels, newspapers, magazines, etc. published in Nigeria in the contemporary times are replete with myriad of language errors. The writers of our time are very conscious of what they gain materially at the expense of the quality of their works. Consequently, they are in a hurry to publish without recourse to basic publishing procedure, especially editing. This observation is summed up by Egya (2009):

Read the writing of these new writers and you will find all sorts of grammatical errors, spelling slips, chaotic imagery, warped linguistic judgment, jerky expressions and tendency to over-write. You will see that editor is dead in our generation. You will see that the very best way to get your children to know bad English is to put in their hands books, creative or not, published in Nigeria in the twenty-first century (p.10).

2.4 Motivation Factor

Motivation, according to Applied Linguistic scholars plays a vital role in the process of language acquisition and learning. It is in agreement with this view that Aliyu (2002) opines that “most language learners require both instrumental and integrative types of motivation to do

well in the school programme” (p.349). Before the 21st Century, the knowledge of English and/or a good pass in English attracted some benefits. For instance, WAEC in those days in its classification of result placed English above any other consideration. No result no matter how good was classified under Division I or II without a pass in English. Also, employers in those days preferred candidates who passed English to others who had good results but did not pass English. In addition, in those days the admission policy was such that only candidates who had a minimum of a credit pass in English were considered for admission for any course in any tertiary institution. These benefits which a pass in English attracted in those days were the driving force which spurred learners of English into more serious efforts towards the learning of English. Today, these benefits have been de-emphasized. For instance, WAEC had long abolished classification of results in divisions. What really counts now is no longer the division of one’s result but how many credits or passes one makes, whether English is included or not. Similarly, employers of labour no longer place emphasis on a pass in English before considering an applicant for employment since School Certificate hardly fetches any employment these days. On the issue of admission, a credit pass in English is no longer a pre-requisite for admission in the areas of science and engineering in some universities. With these developments in place, the contemporary learners of English in Nigeria appear not properly motivated.

2.5 Decline in Extensive Reading Culture

Another characteristic feature of the 21st Century that has been identified to be inimical to effective teaching and learning of English in Nigeria is decline in extensive reading culture. The poor attitude of Nigerians to extensive reading has always been aptly captured by the joke: “If you want to hide something from a black man, enclose it in a book and place it on the centre table. He may never find it because he won’t read the book”.

A good number of the contemporary Nigerian students give much time to frivolities at the expense of more rewarding activities such as extensive reading. For instance, many of them are in the habit of watching home video films most of the time to the extent that they have little or no time for other useful academic activities. For others, even their handsets are a source of distraction as they prefer fondling with them all day long at the expense of more rewarding activities.

Commenting on the poor attitude of the contemporary Nigerian students to extensive reading, Ikonta (2004) observes that “students limit their reading and learning to prescribe texts for specific examinations but hardly indulge in recreational reading” (p.10). Corroborating Ikonta’s observation, Fagbemi (1977) opines that:

Even students who are supposed to widely read may read when examination is close and for many, the textbooks may be the beginning and end of reading. It is not out of place to find a university graduate confessing hardly reading novels pleasure. Even newspapers are like a taboo to some (p.63).

Research findings have consistently pointed to the fact that there is correlation between extensive reading and effective learning of the target language (Stotsky, 1983; Aboderin, 1985; MacGowen-Gilholy, 1995; & Ikonta, 2004). Therefore, it goes without saying that if Nigerian learners of English have poor attitude to extensive reading, their learning of English is everything but effective.

3. Prospects

From the foregoing, it is crystal clear that the teaching and learning of English in Nigeria in this millennium is tremendously handicapped. Therefore, if the sanctity of English

must be maintained for it to continue to play the expected role in the educational, social, political, economic and technological sectors of the Nigerian society, radical measures should be urgently set in motion to address the identified encumbrances which have continued to stunt effective teaching and learning of English in Nigeria in this millennium. In doing so, the teacher factor should be fundamentally addressed. Beginning from the primary school, since the existing policy has made NCE the minimum qualification for teaching in primary school, we wish to advocate that the NCE curriculum be reviewed to ensure that NCE students undergo thorough instructions in all primary school subjects including English. Also, only those who show ample evidence of proficiency in the subjects, especially English, should be certificated. In addition, the teaching of English in primary schools should be the exclusive responsibility of specialist teachers in English, who are expected to lay strong foundation in the pupils on which future knowledge of English would be conveniently built.

To address paucity of qualified English teachers that has hitherto militated against effective teaching and learning of English at the secondary school level, the Federal Ministry of Education should come up with a policy that would encourage students to take to teaching profession. Scholarship and bursary schemes should be put in place to serve as incentives that would attract students to study English/Education. Serving English teachers should be encouraged to go for higher degrees in English through in-service programmes. They should also be encouraged to attend conferences, seminars and workshops on English in order to update and up-grade their professional competence.

The teachers of English at all levels have the responsibility of ensuring that learners of English see the ICT as an aid to effective teaching and learning of English and not a source of distraction. The teachers should therefore endeavour to be computer literate so that they would be in a position to harness the different resources of the ICT that can enhance effective teaching and learning of English.

The English teachers should be conscious of the existence of wrong models, which the learners are exposed to on daily basis and map out strategies for countering them through effective classroom teaching. In class, the teacher should draw the attention of the learners to such wrong models and give detailed explanations on why they should be avoided. Publishers of reading materials should be alive to their professional responsibility by ensuring that whatever they have accepted to publish pass through a thorough editorial process so that in the end the published reading materials are error free as much as possible.

Learners of English should be adequately motivated. On the part of the employers of labour, they should revert to the old order, when jobs meant for School Certificate holders were exclusively reserved for those who passed English. Also, the admission policy in our tertiary institutions should be reviewed to ensure that a credit pass in English remains a pre-requisite for admission for any course irrespective of the faculty or department.

Above all, extensive reading should be encouraged at all levels of education. At the primary and the secondary school levels, extensive reading should be taught as a core subject, which should be offered by all irrespective of one's area of inclination. At the tertiary education level, it should be taught as one of the general study courses, which should be compulsory for all students throughout the duration of tertiary education. For effective implementation of the extensive reading programmes in our schools and colleges, reading teachers that are hitherto lacking in our schools should be produced. In doing so, the departments of English in collaboration with schools of education in colleges of education and universities should come up with feasible academic programmes that would produce NCE and degree reading teachers as it is the practice in oversea countries.

4. Conclusion

It is a statement of fact that English occupies a prestigious position on the linguistic hierarchy in Nigeria. For one thing, it plays an indispensable role in the educational, social, political and economic sectors of Nigeria. And from all indications, the status and role of English in the Nigerian linguistic environment will most likely remain so for a very long time to come. Therefore, any factor that will retard effective teaching and learning of English in Nigeria, such as the ones identified in this paper should be drastically and radically addressed as proposed in this paper so that the teaching and learning of English are repositioned for a better result.

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Religious Ethics and Leadership: Challenges for our Contemporary Society

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Abstract

Leadership is an art of reciprocal between the led and the leader in a particular space or circumstance. The concept can equally be defined as the capacity to move ,inspire , mobilize and guide the activities of people .The most fundamental dimension of leadership phenomenon is to nurture a set of values and beliefs that will answer the question about social welfare of the humanity. Today people are so desperate to secure power and rule by all means. This invariably brings about oppression, corruption, poverty, suffering and backwardness on the part of the society. Perhaps, bringing God into it might have had positive effects if not the neglect of religious ethics. The main objective of this paper is to examine the concept of leadership from moral perspective with a view to evaluating the nature and structure , value systems , moral implications and the challenges that surround leadership phenomenon . Recommendations were then given in order to provide more insights to transform the social order of leadership in the contemporary society.

Key words: Leadership, Challenge, Society, Ethics, Contemporary

Introduction

Nigeria is a country richly blessed with human and material resources, yet very clearly, also endowed with more than its share of bad leaders. This is because, the degree to which Nigeria sunk into moral decrepitude due to the mismanagement of the nation by the Military and Civilian rulers cannot be overemphasized. The fact remains that leadership problem is not limited to only government office holders; the phenomenon rears its ugly head in churches, mosques, family life affairs, towns, villages among others.² It is horrifying for Nigerian society to have been dubbed as the most corrupt country in the world. Worst still, it is observed that some Nigerian citizens equate themselves with the richest in the world so far those citizens have more than enough money stashed in foreign banks. While majority of the people are wallowing in abject poverty, find it difficult to afford one square meal a day. Akinyemi corroborates that Nigerian economy is not the type that can develop billionaires without being corrupt; and the Country no longer has values to hold on to as both the old and the new generation of Nigerians are corrupt. Parents not only encourage their children to beat the system, they aid and abet the children in the nefarious activities. No one believes anymore in the concept of society, but everyman for himself and God for all.³

The story is not different from other parts of Africa such as: Liberia, Botswana, Swaziland, Uganda, Ghana, Gambia, Guinea Bisau, South Africa, Malawi, Lybia, Mali, Cote de Voire among others. In these places, sad stories of corruption, poverty, disease and death are brought upon the governance as a result of selfish, corrupt and inept leaders.⁴ As it follows, moral issues arise fundamentally when the choices people face affect the well-being of others by either increasing or decreasing it, causing either harm or benefit. The well-being involved can be physical or psychological.⁵ In the light of this, the concepts; leadership vis-à-vis governance or leadership vis-à-vis follower are complementary in the social structure and value system of our contemporary society. In a similar vein, John Maxwell submits *inter alia* that "You are not a leader if no one is following".⁶ It implies that the leadership relation is not established in the abstract, rather, it occurs between people who belong to a social structure, that is to say, members of various groups having well defined positions.

However, competent leadership is the key to maintaining high motivation, morale and welfare within the group. In the light of the above, the aim of this paper is geared towards refocusing and appreciating the basic conditions for the establishment of a virile leadership relation between would-be leaders and followers. The paper is divided into five sections. The next section examines the concepts: ethics, leadership vis-a-vis followership, and society. Besides, the paper equally sheds light on religious ethics and leadership. More importantly, the third section explicates the position of leadership and governance phenomenon in the social structure of our contemporary society. The fourth unit examines tasks for planned and emergent leadership for building a viable society. Then, the final slice gives the conclusion.

Conceptual Illuminations

In this section, contextual definitions of the key terms used in the work were offered. This is done to forestall for unintended interpretation of these terms: ethics, leadership and society.

The concept ethics is the study of moral conduct. The word can still be applied to the system or code to be followed.⁷ Nordenstam Tore thought that the task of normative ethics is to determine a life one ought to live. Nevertheless, the word ethics in this context refers to all those ideals, norms, conceptions of right and wrong, good and bad which together make up the ideal of the good life. As it follows, religious ethics also refers to ideas of life, what one should and should not do, what is good and what is bad.⁸

Moral issues arise fundamentally when the choices people face, be it leaders/led or leadership/followership, affect the well-being of others; cause harm or benefit. The well-being involved can be physical, psychological or existential which include death, injury, disease, disability, physical pain, hopelessness, despair, unhappiness, anxiety and sadness. Although, it is obvious that there is a slight difficulty in deciding what makes an issue a moral issue⁹, we shall use the above working definition and explanation as our model in the context of this paper.

Webster's dictionary defines leadership as the ability to lead, show the way, conduct, guide, direct the course of another by going before or along with them.¹⁰ It connotes that leadership is the power of control over a group of people. Thus every society or community has its own leaders such as schools, churches, mosques, offices, businesses, etc. Leadership in this context is the ability to inspire, direct, motivate and encourage others positively to a successful end. Equally important, leadership is about rising to the occasion by organising and adequately coordinating the resources of time, relationships, skills, expertise and finances with a view to achieving a goal for the good of all, that is to say, the followers or governance.¹¹ The working definition is in conformity with Lord Montgomery's assertion that, "leadership is character which can inspire confidence in other people."¹² In sum therefore, the concept, leadership includes a person who has been appointed to direct the attitudes and actions of others. As it follows in this paper, a leader is also a person who emerges from the mass and exercises influence on the attitudes and actions of others.

Society is a complex word because it has several dimensions. In view of this, a working definition is pertinent for our present purpose. This is because no single definition satisfies all who are concerned with a study of society.¹³ It is important, however, to note that every definition of society takes account of three basic concepts, namely: people, institutions and relationships. Then, for our present purpose, society means a group of people.¹⁴ In other words, society is a community in which its inhabitants interact with one another; meet their needs for survival and welfare; seek to develop their unique style of life and work out their problems of group living. These groups of people known as society usually reflect on their past and present circumstances which have made them what they are and which are likely to carry them forward into the future.¹⁵ This actually leads to group interaction, social solidarity, harmony, progress and development.

Religious Ethics and Leadership

The fundamental significance of religion has been confirmed by the experience of human life. In situations of insecurity, anxiety, failures, frustrations, poverty, sickness and death, the solutions are always directed to the leadership. In view of this observation, religious ethics manifest a kind of model for leadership in which our contemporary society should learn from and make use of.¹⁶ Krishnapada opines that all great scriptures of the world emphatically declared that peace and well-being are the result of humanity's recognition of God's supremacy. He further submits scriptural passages to attest to his observation (Rom 10:13; Psalm 113; Quran 7:180; 17:110. The Book of Mormon page 282 verse 17 and Bhagarvad-gita 10:16.)

In a similar but different study, Abdul-Baha posits that the greatest name carries the highest vibration and that the vibration produces a special result.¹⁷ Particularly in Judeo-Christian tradition, people like Moses, Ezra, Nehemiah, Esther, Joel, Gideon, Paul manifested exemplary leadership (Deut chapter 8; Ezra chapter 8; Nehemiah chapters 1-5; Esther 4:16; Joel 2:12, 13, Judges Chapters 6-7; and Rom. Chapter 17.) These leaders demonstrated their love for their people and the society by offering more protection as well as great sense of security.

On the other hand, the leaders automatically receive more support, cooperation and love in return.

The experience above connotes the importance of calling upon the names of God to acquire more unity, peace and divine blessings. When crises and natural calamities occur, leaders should request religious groups or individuals to call upon their holy names according to their particular traditions. More importantly, whether one is a world leader or a leader in another capacity, one can recognise the importance of spirituality, honouring its power to create unity within diversity.¹⁹ In this perspective, the leadership and the led need to devote themselves in sincere and active assistance to their fellowmen along the line of religious ethics.²⁰ Leaders should be goal-oriented, efficient, inspiring, exemplary, caring, unifying and responsible. (Isaiah 42: 8,12; Jer 13:16; Prov 28:23; Prov 24:11-12; Prov 15:15; 19:20)²¹

In view of the fact that peace and well-being are the result of humanity's recognition of God's supremacy, a good leader should promote the harmony by visiting the major religious festivals of each tradition, associating with people by emphasizing the need for unity. Besides, the spiritual dimension of leadership can create a higher level of consciousness among the society, organisations and families. It is this consciousness that will engender social reconstruction of economic, political and social welfare of the society.²²

The Position of Leadership Phenomenon in the Social Structure of Our Contemporary Society

Perrin Jassy is of the opinion that the leadership relation is not established in the abstract but it occurs between people who belong to a social structure, members of various groups in which they have well-defined positions.²³ According to him, the social structure makes reference to relationship between the members of particular groups such as the kinship group; the neighbourhood; village community; the religious organisation among others. Perrin Jassy also identifies two dimensions in the leadership structure which are horizontal and vertical social structures.²⁴ He submits that horizontal level includes relationship between people who have equal rights and duties, for example, brotherhood. While vertical level includes relationships between people who are in a situation of authority or obedience towards another. An examples are the relationships between father and son, king and chiefs, governor and commissioners, president and ministers.²⁵

However, it is observed that all groups in the social structure of our contemporary society have a vertical dimension whether rudimentary or not, even in a social club and informal gathering of friends.²⁶

Types and Styles of Leadership in Our Contemporary Society

The types and styles of leaders are itemised briefly:

- Traditional leaders which include paramount chiefs such as Obas, Obis, Waziris and Emirs.
- Elected/appointed leaders are persons elected by the people through voting such as President, Governor, Councillors and Local Government Chairman. Examples of those by appointment are Ministers, Commissioners and other political appointments.
- Military leaders are the people who seize power by force. Examples are General Gowon, General Babangida, Late General Abacha and Generals Murtala/ Obasanjo.
- Religious leaders are heads of various religious institutions in Nigeria such as Pastors, Bishops, Imams, Priests, Shehu, Sheriff and Caliphs.²⁷

Leadership Styles

Totalitarian style of leadership uses absolute powers and as well has monopoly of power. Democratic style of leadership is a leader being elected by people, and the leader allows everybody to have a say and influence in decision process. Pseudo-Democratic style of leadership allows everybody to have a say in the decision-making but may not influence decision-making. Laissez Faire style is also a leader who gives people free hand to do and undo in decision making process. Aristocratic style of leadership emerges from powerful, established or rich families and as such it is referred to as `Oligarchic Leader` Charismatic style of leadership is a self-made leader who is loved by all well-meaning people. Hence, there is always consensus whenever decisions are to be made and the leader is well-respected by his people.²⁸

Value System and Leadership Phenomenon

This section intends to look at the value system of leadership position. A leader should be able to initiate action for members of his group and organise the people to achieve the goals of the society. He should promote the interests of his society and its members. Dokun Gbaiye remarks that a leader should unite and organise members of his society to achieve their goals. A leader needs to educate the members of his society about what they need to know with a view to communicating with members of his society.²⁹ He should also teach, enlighten, and encourage his people all the time. Moreover, a leader should not force his followers to accept his decisions. He should leave office, that is, resign, if he is told to do so through election or public opinion. In shedding more light on value system of leadership, Perrin Jassy argues that leadership is not a gift but a relationship between the leader and the led, which can be established only on certain conditions. He further argues that a number of factors such as honesty, loyalty, generosity, humility are involved. And that the illusion created by misleading appearances are responsible for the popular concept of leadership as an inborn quality of the leader.³⁰ In this vein, four basic conditions for the establishment of a leadership relation between would-be leader and followers are espoused. They are: that there should be conformity of the leader to the expectations of his followers; that there should be the existence of a `situation`; a consensus as well as leader's ability to communicate. Finally, there should be the position of the leader in the social structure. However, he corroborates that each of the factors creates a potential for leadership. Nevertheless, all the conditions should be present for the exercise of effective leadership in our contemporary society.³¹

Moral Implications and Challenges for Planned and Emergent Leadership

In Nigeria and elsewhere in Africa, the various leadership styles have played themselves out without much satisfaction. The autocratic traditional rulers and authoritarian military dictators such as Abacha, Babangida have held sway at different times and locations. The trait, style and behavioural systems have operated singly or in concert at different times in the chequered history of Africa. In our contemporary society, leaders have held their citizens captive and readily inflict more pain on the citizens by withdrawal of subsidies, retrenchment, currency devaluation and privatisation.³² Such leaders think that increased production is everything and the welfare of citizens is merely given secondary importance.³³ Yet, in our contemporary society, a religio-ethical and effective style should be evolved with concern for issues of social justice and welfare conditions of the people. Hagher argued that the evolution of effective leadership is crafted out of four building blocks which are; vision, character, competence and charisma.³⁴ His observation is worthy of note when he declares that:

I have in my political career won two federal constituency elections; one for Senate in 1983, and another to the Constitutional Conference in 1994. A year

*and half earlier, I took the words of the Lord in Matthew 28:18 for me to know that all power including political power belongs to Jesus and that his timing, whether to win or lose, was perfect. I cannot describe the peace that came over me after I had congratulated my opponent, Senator David Lornem, soon after the results were announced. We have remained since that day, the best of friends.*³⁵

It connotes that our leaders should imbibe the spirit of tolerance and other ethical values such as godliness, truth, loyalty, responsibility, and accountability. Leroy equally reports that one of the great Kings of France said that, 'if truth be banished from all the rest of the world, it ought to be found in the hearts of Princes'.³⁶

Of importance, there is power in following good examples by our leaders. This is because human being can learn things he never dreamed possible when someone shows him how. This implies that challenge without the know-how often leads to defeat, and defeat demoralises.³⁷ Just as defeat demoralises, victory motivates. At this juncture, if the leader should take the time to lead his people through the steps of followership, he is bound to have a victorious band of joyful, productive, motivated people whose lives would bring glory to God and blessing to those around them.³⁸

In addition to the above submission, the leadership role of women in our society is absolutely essential. In Nigeria, the women have performed very well, where the men allowed them; as Ministers, Vice Chancellors, Judges, Senators, Chairpersons of Corporations, Parastatals among others. There is no doubt that women will make good Presidents and Heads of States if given the opportunity. Margaret Thatcher, one of the longest-serving and most successful Prime Ministers of Britain in this century opines that, 'in politics, if you want anything said, ask a man, if you want anything done, ask a woman.'³⁹ The implication of this is that all over the world women are the centre of the most creative projects in social service and community building, rural reconciliation and economic justice, religious life, political action and alternative models.⁴⁰

In the light of the virile leadership role of women across the globe, we may posit that in our contemporary society, we need insight and energy to transform the social order of leadership as regards gender equality. This is because, without gender recognition, society simply cannot and will not change. However, it is observed that in Nigeria, the main religions; Christianity, Islam and African Traditional Religion with the exception of Temearus⁴¹ meaning the creatress of all things among the Ijaw, are of masculine origin and male oriented. This belief has provided for the dominance of the man over the woman as weaker sex. On the other hand, a look at the Holy Quran reveals that women are expected to play a dignifying role of mothers at home and not to be lady Imams.⁴² One does not know any passage in the Holy Bible which says that God is a man or woman. The general consensus is that angels are spirits and there is nothing to show that they are men or women.⁴³ Nevertheless, during the industrial age, it was logical for men to argue that women are the weaker sex and therefore could not perform certain functions like foot soldiering. Now, our contemporary society among other vogues are now in computer-information age, so we now have "digital soldiers" that are indeed unisex, smarter, and deadlier in nature as reflected during the United States of America and Iraqi war of terrorism-in the year 2003.⁴⁴ Then, there should be no discrimination against women leadership in the social order of our contemporary society. Also, there should be a refocused and broad insight and energy to transform leadership position in the society.

Conclusion

The discussion highlighted the religious ethics and leadership position in our contemporary society. Thus, the paper discussed some key concepts and the context in which they were used. Moreover, the paper also gave the exposition of the place of leadership phenomenon in the social structure of our contemporary society. As a rider, the paper identified and examined types, styles and value systems of leadership. Moreso, it was discovered that there are some basic conditions for the effective leadership and followership in the modern society of nowadays. Based upon this premises, the paper finally raised and explicated a kind of moral implications and challenges for planned and emergent leadership in our society.

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Students' Reflections: A Case Study on Problem-Based Learning Approach in Malaysia

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Abstract

This paper concerned Malaysian undergraduate science physics students' and pre-service science teachers' perceptions of learning through Problem-based learning (PBL) delivered via online. Specifically, it required to ascertain whether students had positive perceptions of the intervention of PBL. Learning outcomes was the main focus. 50 students were involved in this study which consists of 30 students from the School of Science and Technology (SST, science student) and 20 students from the School of Education and Social Development (SESD, pre-service science teachers). Both programmes were from University Malaysia Sabah. Ten collaborative groups were then formed (4-6 students in each group). The students then followed all the PBL learning activities for sixteen weeks. In addition, online learning environment (i.e., learning management system, LMS) was used as the main medium to carry the full learning process throughout the second semester of 2008/2009 academic year. Data were gathered from an established open-ended questionnaire that administered after they completed with the learning activities at the end of the semester. Generally, students' reflection on PBL's specific features regarding to its learning outcomes were significant in every statement. In addition, after analysed separately, SST and SESD's students were also show that their expression were really positive and encouraging thus reflects that this new approach maybe has potential to be implemented fully in Malaysia's higher learning institution.

Keywords: Problem-based learning; learning outcome

Introduction of Problem-Based Learning

Problem-based learning (PBL) is a pedagogical approach to science education that focuses on helping students develop self-directed learning skills (Barrows & Tamblyn, 1980; Boud & Felletti, 1991). It was originally developed in a medical school in 1969 at McMaster University (Rideout & Carpio, 2001), but has since spread to other subjects [e.g., engineering (Awang & Ramly, 2008), Nursing (Baker, 2000), Physics (Dublin Institute of Technology, 2005; Sulaiman, 2004), Biology (Juremi, 2003) and Geography (King, 2008)]. It derives from the idea that education, knowledge and learning is a process in which the learner actively constructs new knowledge on the basis of current knowledge. Unlike traditional teaching practices (which has been used in Malaysia since 1950's) in higher education, where the emphasis is on the transmission of factual knowledge, the courses consist of a set of problems that are carefully sequenced to ensure the students are taken through the curriculum. The students encounter these problem-solving situations in small groups guided by a tutor who facilitates the learning process by asking questions and monitoring the problem-solving process. The ability to solve problems is more than just accumulating knowledge and rules; it is the development of flexible, cognitive strategies that help analyse unanticipated, ill-structured situations to produce meaningful solutions. Even though many of today's complex issues are within the dominion of student understanding, the skills needed to tackle these problems are often missing from our pedagogical approaches.

Research at the School of Physics at the Dublin Institute of Technology in September 2001 pointed to positive feedback from the students engaged in PBL: having fun learning, learning from each other; not falling behind as everyone is constantly learning; more effective learning as it enables students to remember better; students having to interact; and real-life problems seen as more interesting and challenging. PBL is not just about problem solving, and it is important to distinguish between PBL and learning via problem-solving learning. In physics, the use of problem-solving learning is well established, and in this method the students are first presented with the material, in the form of a lecture, and are then given problems to solve. These problems are typically narrow in focus, test a restricted set of learning outcomes, and usually do not assess other key skills. When learning in this way, students do not get the opportunity to evaluate their knowledge or understanding, to explore different approaches, or to link their learning with their own needs as learners. They have limited control over the pace or style of learning and this method tends to promote surface learning (Woods, 1994). Surface learners concentrate on rote memorisation (Araz & Sungur, 2007); this often arises from the use of didactic 'spoon-feeding', which does not encourage students to adopt a deep approach learning (Kember, 2000; Kit Fong, O'Toole, & Keppell, 2007). Deep learners, in contrast, use their own terminology to attach meaning to new knowledge (Rideout & Carpio, 2001). In PBL, the students determine their learning issues, and develop their own unique approach to solving the problem. The members of the group learn to structure their efforts and delegate tasks. Peer teaching and organisational skills are critical components of the process. Students learn to analyse their own and their fellow group members' learning processes and, unlike problem-solving learning, must engage with the complexity and ambiguities of real life problems. PBL is thus well suited to the development of key skills, such as the ability to work in a group, problem-solving, critiquing, improving personal learning, self-directed learning, and communication.

There has been reluctance to introduce PBL into physics courses due to a view that students require a sound body of knowledge and mathematical skills before they are equipped to engage with this type of approach (McDermott & Redish, 1999). It has been revealed that first year students tend to rely more on lecture notes than students in later years, and that first

year students tend to be assessment driven (Dublin Institute of Technology, 2005). However, it has been reported in the School of Physics in Ireland that PBL can be introduced successfully into first year, if it is facilitated correctly and the tutors are aware that the students are only in the early stages of developing as self-directed learners (Dublin Institute of Technology, 2005).

Different from the PBL norm, traditional learning is the learning styles that been widely used in Malaysia (Ahmad, 1998). The learning activity follows typical traditional face-to-face classroom approach, where students are given lecture notes to read and study. At the end of each topic, students are given tutorial questions or homework they have to answer and send to lecture or tutor as usual. No further learning activities would be done other than these teaching and learning activity.

Students' Perception of PBL from other Research

Research about PBL also has focused on how easily students adapt to what, to many, is a very different learning approach. The results vary with some studies suggesting PBL is acceptable to students, and others indicating that although a PBL-based curriculum is initially perceived positively, there are limitations and restrictions and ways that PBL can be improved. Studies that report positive findings are presented first, followed by those that were positive about how well PBL was received by students.

The nature of students' motivation in PBL may depend on their academic or professional discipline of study (Dahlgren & Dahlgren, 2002). For example, PBL students in medical school report being satisfied with their learning, and more confident in their understanding than those taught traditionally (Albanese & Mitchell, 1993; Vernon & Blake, 1993). PBL also is popular with younger learners (see e.g., Albion & Gibson, 2000; Gordon, Rogers, & Comfort, 2001; Stepien & Gallagher, 1993), because young students feel the PBL approach, with its active learning and teamwork, makes learning relevant and enjoyable. In addition, teachers report that younger students' behaviour improved when PBL was utilized (Albion & Gibson, 2000).

The literature suggests that PBL works well with complex abstract subjects like physics. Kampen, Banahan, Kelly and McLoughlin (2003), for example, report that students studying thermal physics found the topic significantly more interesting and relevant. Such a positive perception of PBL may be because it inspires greater motivation and provides satisfaction, because it provides demonstrable and tangible outcomes (Earthman & Nieves, 2000; Gackowski, 2003; Sulaiman, 2004). Students also report PBL as an effective means of learning their course material (Sulaiman, 2004). Typically, such students emphasized the 'realistic', 'hands-on', and/or 'big' picture' qualities PBL provides. Moreover, students report they accrue teamwork skills, and becoming a more resourceful learner. Positive comments also typically mention that PBL improved students' learning process, communication skills, and ability to solve real-world problems (Gackowski, 2003).

At least some part of these positive perceptions of PBL may be due the differences in assessment of learning in PBL approaches. Bowe (2005) reports that, in PBL, the assessment strategy is seen by the students as supportive and helpful in terms of their development as a member of learning group – in other words, the formative nature of the assessment was appealing. Other factors are the supportive nature of the PBL learning environment, with Sulaiman (2004) reporting that students find their skills in the discussion room improve when they can talk on any particular matter about their study without anxiety or being rejected by their friends (see also Bowe, 2005). Motivating factors also come from the realism that experiential learning brings into the process (Gackowski, 2003). Such features of the learning environment enhance students' affective, attitudinal, ethical and behavioural dimensions of

learning (Gackowski, 2003). Students also report that PBL helps them to address real-life challenging problems though engaging with their own learning processes, meaning they had to become self-directed learners and to collaborate with and rely on peers as well as confronting the challenges of group dynamics (Spronken-Smith, 2005).

Recent research suggests that students think greater engagement with real-life problems/tasks created in PBL scenarios encourages them to think about the diagnostic processes involved in problem-solving (Gossman, Stewart, Jaspers, & Chapman, 2007). For example, PBL provides motivation and encourages discussion about searching for information, and students say this makes them more capable, and increases their ability to solve problems more appropriately in physics (Kampen et al., 2003; Sulaiman, 2004). Students thus are generally enthusiastic about PBL, and welcome the approach, finding it a refreshing and enjoyable change from traditional teaching (Spronken-Smith, 2005). There also appears to be evidence that students take more responsibility for their learning and are able to apply the skills acquired in subsequent lectures and laboratories (Kampen et al., 2003), with many students keen to see PBL used for other topics and courses (Sulaiman, 2004).

Students' perceptions of PBL fall into four main categories (Spronken-Smith, 2005): students' understanding of PBL; initial struggles with PBL instruction; the domination of PBL in study; and skills gained in PBL. Some students see PBL as something of a burden because the format of the course is so unlike a traditional class or lecture (William, Macdermid, & Wessel, 2003). Nevertheless, Spronken-Smith (2005) says that whilst PBL is not favoured by all students, the majority value PBL because although it is challenging, students feel empowered as learners. This view resonates with the views of Harland (2002) and Silen (2004) who report that PBL students developed a new awareness of learning and metacognition – consistent with the beliefs of Biggs (2003) and Ramsden (2003) that in a PBL course, students are more likely to take a deep approach to learning.

Hmelo-Silver (2004) claims that there is little research that bears directly on the issue regarding students' motivation, rather than their satisfaction and confidence. He insists that enhancing student motivation is purported to be a major advantage of PBL, because learning issues arise from the problem (in response to students' need to know), meaning that intrinsic motivation is enhanced. However, some students resist changing their way of learning, and do not like working collaboratively. Derry, Levin, Osana, Jones, and Peterson (2000) argue that such views may be as a result of the amount of time taken up by PBL or that the topic is not appropriate to PBL, since students need time to understand the nature of PBL (see also, Kampen et al., 2003; Sulaiman, 2004). The literature suggests there are a number of 'worst case scenarios' for implementing PBL: the problem itself can create confusion and frustration among learners; the instructors' role may result in ineffective facilitation and superficial discussion; and the learner can experience helplessness with little sense of learning, resulting in a failure to learn either content or process skills (Tan, 2004).

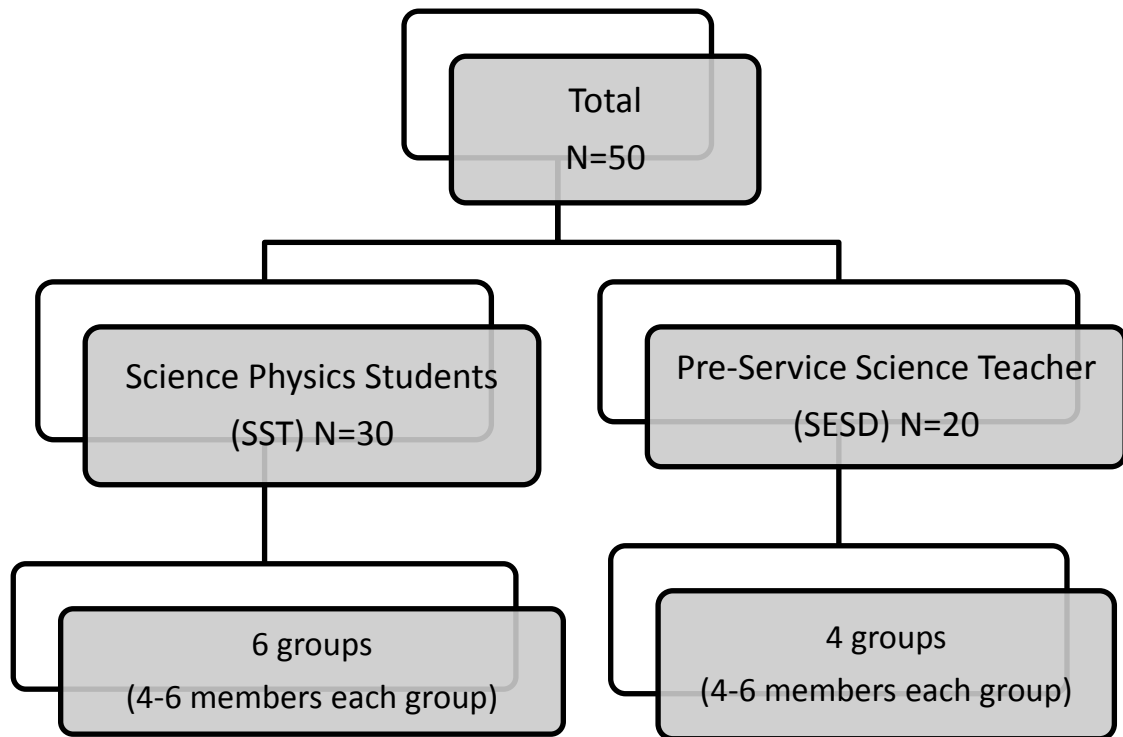
Therefore the main objective for this paper was to seek and to discover what the students' awareness is in terms of students' reflections on PBL approach.

Methodology

The study was conducted throughout Semester II during the 2008/2009 academic year at the University Malaysia Sabah (UMS), Malaysia. Fifty students were involved, which consist of thirty science physics students from Physics With Electronic Programme at the School of Science and Technology (SST), and another twenty pre-service science teacher from Science Education Programme at the School of Education and Social Development (SESD). The samples pursued all the PBL learning activities (i.e., collaborative learning, independent

learning, self-directed learning, and reflective learning) in an online learning environment (i.e., learning management system, LMS) which acted as the main medium to support the full learning process throughout the semester. The students then divided into ten small groups which contain 4-6 students. The flow of group sample shows in Figure 1.

Figure 1: Group Sample for the Study



The intervention was conducted within 16 weeks. During this intervention, all the teaching and learning assessment being delivered using the learning management system (LMS) organised by Educational Technology and Multimedia Unit (ETMU) at the Universiti Malaysia Sabah. The researcher prepared the LMS followed the PBL criteria to fulfilled the learning and teaching activities via online.

The learning activities started with problems. After they encounter with the problem, they have to find their own information, knowledge and sources in order to find the appropriate solution. They can either find the solution via Internet, interview lectures or tutors, from text books, observation or any other methods in sequence to find adequate information to solve their problems. The students in PBL group also have to access to the LMS to do their chat room at least once in a week and monitored by a facilitator. In this chat room they will argue, share thoughts and most probably constructed their own thinking regarding to the particular problems. They also be able to enter the forum room to post any inquiries or any ideas asynchronously. Additionally some linkages, sources and lecture note also uploaded by the facilitator for them just to ensure the students did not lose their ways in sequence to find the suitable solution and just to give them the correct path in searching their resource. They had been given two weeks for each problem to solve before passing up, and there were five problems need to be solved throughout the semester. This LMS system was using Moodle2007 course management systems. Jayasundara et al. (2007) suggested that the PBL online service and implementation rate of system perhaps more improve and even better if it is incorporated with existing course management systems such as Moodle2007 and Blackborad2007.

In this study the intention was to investigate students' reflections of PBL approach. The data were collected through a well developed survey which has $\alpha = 0.83$ Cronbach's Alpha. The survey was filled one week after their finish with the intervention.

Findings

The research question for this paper concerned the Malaysian undergraduate science physics students' and pre-service science teachers' perceptions of learning through PBL delivered via online. Specifically, it required to ascertain whether students have positive perceptions of PBL.

Thus the main objective was to seek and to discover what the students' awareness is regarding PBL online method in terms of 'students' reflections on PBL approach'. Students from the SST program are considered first, followed by those from the SEDS program.

To analyse this data, two methods of analysis were used: non-parametric techniques, the binomial analysis (cut point value 3.5), and the t-Test for One Sample (test value = 3). Comparisons in general were analysed first, followed by the separate data analyses for SST and SEDS students.

The results shown in Table 1 show that, in general, the students' perceptions of learning through PBL were very positive in terms of the affective effects and their process of learning. Statements that attracted means more than 4 from 5 Likert scales include the PBL as an effective students-centered approach; understanding of Modern Physics improved; more engaged in their study; and made better connection within the course. Additionally they enjoyed the study more; became more interested in their learning; and became more motivated.

Table 1 also suggest that the SST students' perceptions of learning through PBL were also very positive in terms of the affective effects and their process of learning, as in the general analysis. SST students also found that their reflective thinking had been increased as a result of using this approach to learning. The results indicates that there are statistically significant differences in perceived learning outcomes for SST students' who participated in the in PBL approach (using the binomial test, based on Z approximation, all the asymp. sig. 2 tailed for all statements indicates that $p^* < 0.05$). Analysis using the One-Sample t-Test for test value = 3.5 also indicated that the majority of the students agreed that they had positive reflection responses to the PBL approach. Thus, overall SST students reacted optimistically to the PBL approach.

In a similar manner to the SST students, two methods of nonparametric analysis to were used to interrogate the data for SEDS - the binomial analysis, cut point value 3, and the t-Test for One Sample (with a test value = 3.5). The results indicate that there are statistically significant differences in perceived learning outcomes for SEDS students who were exposed to the PBL learning approach. Based on the binomial test, with the Z approximation, all the asymp. sig. 2 tailed for all statements indicate that $p^* < 0.05$. Likewise, analysis using the One-Sample t-Test with the test value = 3.5 suggests that majority of the students also react positively to PBL approach. SEDS's column reveals almost the same findings as with SST students where the students' perceptions of learning through PBL were very positive in terms of affective effects and their process of learning. Statements that produced means more than 4 from 5 Likert scales include the PBL as an effective student-centered approach; understanding of Modern Physics improved; more engaged in their study; and had made better connection and relevancy to each topic they have learnt. Moreover, their learning become more enjoyable; became more interested in their learning; gained more confidence; and became more motivated as the result of the instructional method.

Table 1: General comparison of undergraduate physics science students' and pre-service science teachers' perception of PBL - Part B: Students' reflection on PBL's specific features.

Statement	General Comparison Category (N=50)			SST's Category (N=30)			SESD's Category (N=20)		
	Analysis Method 1		Analysis Method 2	Analysis Method 1		Analysis Method 2	Analysis Method 1		Analysis Method 2
	Group 1 <= 3.5	Group 2 > 3.5	Mean (SD)	Group 1 <= 3.5	Group 2 > 3.5	Mean (SD)	Group 1 <= 3.5	Group 2 > 3.5	Mean (SD)
1 PBL is one of the effective student-centred approaches.	5	45	4.10* (0.69)	3	27	4.05* (0.49)	2	18	4.19* (0.93)
2 The learning activities in the PBL groups were enjoyable.	6	44	4.23* (0.75)	5	25	4.00* (0.79)	1	19	4.56* (0.56)
3 I feel that my understanding of modern physics improved as a result of using this approach to learning.	3	47	4.10* (0.53)	3	27	4.05* (0.62)	0	20	4.19* (0.36)
4 I was actively engaged in learning when using this approach to learning.	9	41	3.94* (0.84)	7	23	3.81* (0.77)	2	18	4.13* (0.91)
5 My confidence as a problem-solver increased as a result of using this approach to learning.	6	44	3.94* (0.70)	4	26	3.90* (0.58)	2	18	4.00* (0.86)
6 My interest in learning modern physics increased as a result of using this approach to learning.	3	47	4.09* (0.62)	2	28	4.19* (0.50)	1	19	3.94* (0.76)
7 My ability to engage in reflective thinking increased as a result of using this approach to learning.	5	45	3.98* (0.63)	2	28	4.10* (0.45)	3	17	3.81* (0.81)
8 I found the material learned to be of more relevance as a result of using this approach to learning.	4	46	4.03* (0.62)	3	27	4.05* (0.49)	1	19	4.00* (0.79)
9 My motivation to learn modern physics increased as a result of using this approach to learning.	5	45	4.08* (0.68)	3	27	4.10* (0.52)	2	18	4.06* (0.89)
10 My perceptions and point of view in regard to learning modern physics lead to a better connection between classroom and real life as a result of using this approach to learning.	3	47	4.21* (0.73)	2	28	4.14* (0.60)	1	19	4.31* (0.90)

Analysis Method 1 = Asymp. Sig.(2-tailed) 0.00*(a) for all statement

Analysis Method 2 = *Statistically significant differences between PBL mean on Likert Scale with test value = 3.5 (t-Test for One-Sample Test)

Discussions and Conclusion

The research findings reported suggest that the student were keen on and engaged with their learning under the PBL method. In terms of learning outcomes, the majority of the students felt that PBL is one of the effective student-centred approaches. For that reason, they felt able to share their knowledge with team members more effectively. Additionally, they felt that their understanding of modern physics improved as a result of using this approach. The science program physics majors generally noted that this approach improved their problem-solving skills and helped in their being able to connect and build different ideas and points of view. Pea (1993) notes that in PBL, students work together on complex problems, thus sharing the cognitive load among group members, as well as reaping the benefit of distributed expertise within the group. Swapping knowledge and information is a vital part of learning together, as knowledge is constructed socially through joint efforts towards common objectives. However, Rochelle disagreed, saying the very essence of collaboration is the construction of shared meaning (1996). Thus, from a sociocultural perspective, as learners participate in activities, they internalise what they have learned from working together (Palincsar & Herrenkohl, 1999; Vygotsky, 1978). In this study the pre-service teachers all agreed that PBL has increased their motivation to learn Modern Physics and felt that the learning activities in the PBL groups were enjoyable. As a conclusion, students reflections on learning outcomes for PBL approach were very positive

As a conclusion, students' reflection has shown clearly that students welcome the PBL online approach though it still new and it is believed that it also has obstacles and deficiencies in the process of learning. Through the help from the online discussion forums and the help from group members and the facilitator, students felt that they shifted towards independent learning establishing more regular self-directed learning practices in PBL. In addition they were not only engaged with the learning activities, but were also able to extend their knowledge to a more practical and useful level.

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Effects of Aluminium Chloride Exposure on the Histology of Skin of Wistar Rats

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Abstract

Aluminium has the potential to be neurotoxic in human and animals. The skin functions in thermoregulation, protection, metabolic functions and sensation. The skin is divided into two main regions/layers: the epidermis, and the dermis, separated by a basement membrane zone, each providing a distinct role in the overall function of the skin. The purpose of this study was to look out for the possible effects that Aluminium Chloride could have on the histology of skin of wistar rats. Twenty wistar rats were used for this experiment. They were divided into five groups: Group I was the control that received distil water only while groups II, III, IV and V received 475mg/Kg, 950mg/kg, 1,425mg/kg and 1,900mg/kg respectively for duration of eight weeks. At the end of eight weeks of administration, the wistar rats were humanely sacrificed and the skins were collected and fixed in formalin. The skins were processed and stained with Haematoxylin and Eosin (H&E). Our observations revealed that Aluminium Chloride exposure did not have significant deleterious effects on the skin of wistar rats.

Key words: Effects, Aluminium Chloride, Skin, Histology and Wistar Rats.

Introduction

Skin is the largest multifunctional organ of the body and knowledge of its structure and function is essential to clinicians and researchers. It has an area of 2 square metres (22 square feet) in adults, and weighs about 5 kilograms. The thickness of skin varies from 0.5mm thick on the eyelids to 4.0mm thick on the heels of the feet. It is the major barrier between the inside and outside of the body.

The skin is considered the largest organ of the body and has many different functions. It functions in thermoregulation, protection, metabolic functions and sensation. The skin is divided into two main regions/layers: the epidermis and the dermis, separated by a basement membrane zone, each providing a distinct role in the overall function of the skin. The dermis is attached to an underlying hypodermis, also called subcutaneous connective tissue, which stores adipose tissue and is recognized as the superficial fascia of gross anatomy. The skin contains a variety of appendages, mainly hair follicles (HF), sweat glands, and sebaceous glands (SG), which are all embryologically epidermal in origin. Hairs are only found in thin skin and not in the thick skin present on the fingertips, palms and soles of the feet.

There are three major components/layers of the skin. First is the hypodermis, which is subcutaneous (just beneath the skin) fat that functions as insulation and padding for the body. Next is the dermis, which provides structure and support. Last is the epidermis, which functions as a protective shield for the body.

Hypodermis: The hypodermis is the deepest section of the skin. It is missing on parts of the body where the skin is especially thin-the eyelids, nipples, genitals, and shins. The hypodermis refers to the fat tissue below the dermis that insulates the body from cold temperatures and provides shock absorption. It mainly contains adipose tissue and sweat glands. The adipose tissue has metabolic functions: it is responsible for production of vitamin D and triglycerides. Fat cells of the hypodermis also store nutrients and energy. The hypodermis is the thickest in the buttocks, palms of the hands and soles of the feet. As we age, the hypodermis begins to atrophy, contributing to the thinning of aging skin. Subcutaneous tissue acts both as an insulator, conserving body heat and as a shock absorber, protecting internal organs from injury. It also stores fat as an energy reserve in the event extra calories are needed to power the body. The blood vessels, nerves, lymph vessels, and hair follicles also cross through this layer.

Dermis: The dermis is located between the hypodermis and the epidermis. It is a fibrous network of tissue that provides structure and resilience to the skin. While dermal thickness varies, it is on average about 2 mm thick. The dermis assumes the important functions of thermoregulation and supports the vascular network to supply the avascular epidermis with nutrients. It can be divided into two regions: **(a) superficial region** - (papillary dermis) the region around the dermal papillae, which makes up around 20% of the dermis. This layer contains loose connective tissue, and it has many capillaries. It extends up into the epidermis in small projections called dermal papillae. This region also contains Meissners corpuscles, which are touch receptors, as well as, free nerve endings (non-myelinated) that are sensitive to temperature. **(b) Deeper region** - (reticular dermis) this is a layer of dense irregular connective tissue, which contains collagen and elastin, which give skin its strength and extensibility. The collagen bundles are woven into a coarse network. This layer contains fibroblasts, macrophages and fat cells.

The major components of the dermis work together as a network. This mesh-like network is composed of structural proteins (collagen and elastin), blood and lymph vessels, and specialized cells called mast cells and fibroblasts. These are surrounded by a gel-like substance

called the ground substance, composed mostly of glycosaminoglycans. The ground substance plays a critical role in the hydration and moisture levels within the skin.

The most common structural component within the dermis is the protein collagen. It forms a mesh-like framework that gives the skin strength and flexibility. The glycosaminoglycans—moisture binding molecules—enable collagen fibers to retain water and provide moisture to the epidermis. Another protein found throughout the dermis is the coil-like protein, elastin, which gives the skin its ability to return to its original shape after stretching. In other words, elastin provides the skin with its elasticity. Both collagen and elastin proteins are produced in specialized cells called fibroblasts, located mostly in the upper edge of the dermis bordering the epidermis. Intertwined throughout the dermis are blood vessels, lymph vessels, nerves, and mast cells. Mast cells are specialized cells that play an important role in triggering the skin's inflammatory response to invading microorganisms, allergens, and physical injury. The blood vessels in the dermis help in thermoregulation of the body by constricting or dilating to conserve or release heat. They also aid in immune function and provide oxygen and nutrients to the lower layers of the epidermis. These blood vessels do not extend into the epidermis. Nourishment that diffuses into the epidermis only reaches the very bottom layers. The cells in the upper layers of the epidermis are dead because they do not receive oxygen and nutrients.

The junction between the dermis and epidermis is a wave-like border that provides an increased surface area for the exchange of oxygen and nutrients between the two sections. Along this junction are projections called dermal papillae. As you age, your dermal papillae tend to flatten, decreasing the flow of oxygen and nutrients to the epidermis.

Epidermis: The epidermis is a thin outer portion, which is the keratinised stratified squamous epithelium of skin. The epidermis is the most superficial layer of the skin and provides the first barrier of protection from the invasion of foreign substances into the body. It acts as a protective shield for the body and totally renews itself approximately every 28 days. The principal cell of the epidermis is called a keratinocyte. The epidermis is subdivided into five layers or strata: 1) the stratum (basale) germinativum (SG), 2) the stratum spinosum (SS), 3) the stratum granulosum (SGR), 4) the stratum lucidum and 5) the stratum corneum(SC) in which a keratinocyte gradually migrates to the surface and is sloughed off in a process called desquamation.

The stratum germinativum (SG) provides the germinal cells necessary for the regeneration of the layers of the epidermis. These germinal cells are separated from the dermis by a thin layer of basement membrane. After a mitotic division a newly formed cell will undergo a progressive maturation called keratinization as it migrates to the surface. New epidermal skin cells, called keratinocytes, are formed in this layer through cell division to replace those shed continuously from the upper layers of the epidermis. This regenerative process is called skin cell renewal. As we age, the rate of cell renewal decreases. Melanocytes, found in the stratum basale, are responsible for the production of skin pigment, or melanin. Melanocytes transfer the melanin to nearby keratinocytes that will eventually migrate to the surface of the skin. Melanin is photo protective: it helps protect the skin against ultraviolet radiation (sun exposure).

The cells that divide in the stratum germinativum soon begin to accumulate many desmosomes on their outer surface which provide the characteristic prickle of the stratum spinosum (SS), which is often called the prickle-cell layer. The progressive maturation of a keratinocyte is characterized by the accumulation of keratin, called keratinization.

The third layer is called the stratum granulosum, or the granular layer. It is composed of 3-5 layers of flattened keratin—a tough, fibrous protein that gives skins its protective

properties. Cells in this layer are too far from the dermis to receive nutrients through diffusion, so they begin to die. The cells of the stratum granulosum (SGR) accumulate dense basophilic keratohyalin granules. These granules contain lipids, which along with the desmosomal connections help to form a waterproof barrier that functions to prevent fluid loss from the body.

The fourth layer in the epidermis is called the stratum lucidum, or the clear layer. This layer is present only in the fingertips, palms, and soles of the feet. It is 3-5 layers of extremely flattened cells. Epidermis varies in thickness throughout the body depending mainly on frictional forces and is thickest on the palms of the hands and soles of the feet. The stratum lucidum is normally only well seen in thick epidermis and represents a transition from the stratum granulosum to the stratum corneum.

The fifth layer or horny layer is called the stratum corneum. This is the top, outermost layer of the epidermis and is 25-30 layers of flattened, dead keratinocytes. This layer is the real protective layer of the skin. Keratinocytes in the stratum corneum are continuously shed by friction and replaced by the cells formed in the deeper sections of the epidermis. In between the keratinocytes in the stratum corneum are epidermal lipids (ceramides, fatty acids, and lipids) that act as a cement (or mortar) between the skin cells (bricks). This combination of keratinocytes with interspersed epidermal lipids (brick and mortar) forms a waterproof moisture barrier that minimizes trans-epidermal water loss (TEWL) to keep moisture in the skin. This moisture barrier protects against invading microorganisms, chemical irritants and allergens. If the integrity of the moisture barrier is compromised, the skin will become vulnerable to dryness, itching, redness, stinging and other skin care concerns.

In the very outer layers of the stratum corneum, the moisture barrier has a slightly acidic pH (4.5 to 6.5). These slightly acidic layers of the moisture barrier are called the acid mantle. The acidity is due to a combination of secretions from the sebaceous and sweat glands. The acid mantle functions to inhibit the growth of harmful bacteria and fungi. The acidity also helps maintain the hardness of keratin proteins, keeping them tightly bound together. If the skin's surface is alkaline, keratin fibers loosen and soften, losing their protective properties. When the pH of the acid mantle is disrupted (becomes alkaline)—a side effect of common soaps—the skin becomes prone to infection, dehydration, roughness, irritation, and noticeable flaking.

A number of components are common to both the dermis and epidermis. These are: pores, hair, sebaceous glands, and sweat glands.

Pores are formed by a folding-in of the epidermis into the dermis. The skin cells that line the pore (keratinocytes) are continuously shed, just like the cells of the epidermis at the top of the skin. The keratinocytes being shed from the lining of the pore can mix with sebum and clog the pore. This is the precursor to acne. If oil builds up inside pores, or if tissue surrounding the pore becomes agitated, pores may appear larger.

Hair grows out of the pores and is composed of dead cells filled with keratin proteins. At the base of each hair is a bulb-like follicle that divides to produce new cells. The follicle is nourished by tiny blood vessels and glands. Hair prevents heat loss and helps protect the epidermis from minor abrasions and exposure to the sun's rays.

Sebaceous glands are usually connected to hair follicles and secrete sebum to help lubricate the follicle as it grows. Sebum also contributes to the lipids and fatty acids within the moisture barrier. Oil production within the sebaceous gland is regulated by androgen levels (hormones such as testosterone).

Sweat glands are long, coiled, hollow tubes of cells. The coiled section is where sweat is produced and the long portion is a duct that connects the gland to the pore opening on the

skin's surface. Perspiration excreted by the sweat glands helps cool the body, hydrate the skin, eliminate some toxins (i.e., salt), and maintain the acid mantle. (Jason and Jeffrey, 1995).

The circulation of skin: The arteries supplying the skin are deep in the hypodermis. Branches from the arteries pass upwards to form a deep and a superficial plexus.

The deep **cutaneous plexus** is at the dermal/hypodermal junction. It supplies the fatty tissue of the hypodermis, and the deeper parts of the dermis, including the capillaries for hair follicles, deep sebaceous glands and sweat glands.

The superficial **sub-papillary plexus** lies just beneath the dermal papillae and supplies the capillaries in the dermal papillae. The pink colour of skin is mainly due to the blood seen in venules of this plexus.

There are many arteriovenous anastomoses in the dermis, which can prevent blood from entering the superficial cutaneous plexus. This strategy is used as a response to cold as a way of conserving heat. The danger is that if the epidermis loses its blood supply for too long, it will die (frostbite!). Alternatively, when it is hot, more blood is allowed into the superficial plexus, and the skin flushes. The blood in the superficial capillaries is cooled by the evaporation of sweat of the surface of skin.

Aluminium is ubiquitous element and the third most prevalent (abundant) element in the earth's crust, comprising approximately 8% of the earth's crust, exceeded only by oxygen (47%) and silicon (28%). The almost ubiquitous presence of this element has so heavily contaminated the environment that exposure to it is virtually inescapable. The elemental aluminium does not occur in its pure state but is always combined with other elements such as chloride, hydroxide, silicate, sulphate and phosphate. The wide distribution of this element ensures the potential for causing human exposure and harm (Berthon, 1996; Candura *et al.*, 1998; Williams, 1992; Zhang and Zhou, 2005). Daily intake by humans is estimated to be 1-10 mg (0.04 - 0.37 mmols). It is difficult to provide generalized estimates of environmental concentrations because of the complexity of its chemistry which is controlled by pH, mineralogical constituents and the quantities and indeed quality of associated natural organic matter. Due to its reactivity, aluminium in nature is found only in combination with other elements such as oxygen, silicon and fluoride (Jiang *et al.*, 2008; Verstraeten *et al.*, 2008).

Aluminium chloride is an effective antiperspirant that is applied to the skin to control severe excessive sweating (hyperhidrosis) that works by blocking the sweat glands and causes the pressure of fluid within the glands to rise to the point where it shuts off sweat production (www.Net Doctor, 2004). The antiperspirant is applied before going to bed at night and should be washed off in the morning. It should not be reapplied during the day. Overtime, sweating will stop during the day and the number of times you apply the antiperspirant at night can be reduced. Aluminium has a wide variety of uses which include for aircraft, utensils, apparatus and electrical conductors. The coarse powder is used in aluminothermy (thermite process): the fine powder as flashlight in photography, in explosives, fireworks and in aluminium paint; for absorbing gases in manufacturing of steel (www.Net Doctor, 2004).

Evidence for contribution of Aluminium to Alzheimer's disease remains contradictory (Flaten, 2001; Gupta, *et al.*, 2005). Epidemiological studies have indicated a link between Aluminium in drinking water and Alzheimer's disease (AD) and a variety of human and animal studies have implicated learning and memory deficits after Aluminium exposure (Buraimoh *et al.*, 2011a; Exley, 2005; Schmidt *et al.*, 2001; Yokel, 2000). Aluminium Chloride was implicated to have negative effects on behavioural endpoints of wistar rats (i.e. alters behaviour), have negative effects on anxiety-related behaviour of wistar rats as it increased the rate of anxiety in aluminium treated rats and was also said to have neurodegenerative effects

on the histology of cerebral cortex of adult wistar rats especially at higher dose (Buraimoh, et al., 2011b; Buraimoh, et al., 2011c; Buraimoh, et al., 2012a).

According to Dougall (2004), aluminium is present in our water, foods, medications and air. The healthy human body has effective barriers such as skin, lungs, and gastrointestinal tracts, against aluminium. Aluminium Chloride was also said to have detrimental effects on the integrity of the testes of wistar rats, and also decrease the level of sperm count, but did not result into infertility (Buraimoh, et al., 2012b; Buraimoh, et al., 2012c). The purpose of this study was to evaluate the possible effects that Aluminium Chloride exposure could have on the histology of skin of wistar rats.

Materials and Methods

This experiment was conducted in the Department of Human Anatomy, Faculty of Medicine, Ahmadu Bello University, Samaru, Zaria, Kaduna State, Nigeria. Rules and regulations governing animal handling of Ahmadu Bello University were observed.

Experimental Animals:

Twenty wistar rats were used for this experiment. The wistar rats were housed in steel cages maintained at good environmental conditions with sufficient food, water and under good ventilation. The wistar rats were kept for two weeks (14days) before commencement of administration; this was to enable them to acclimatize.

Experimental Design:

The wistar rats were divided into five groups: group I was the control that received distil water only while the four Aluminium exposed groups were given various concentrations of aluminium chloride. The LD50 was 3,800mg/kg. The duration of administration was Eight weeks.

Group I was the Control

Group II received 475mg/Kg

Group III received 950mg/kg

Group IV received 1,425mg/kg

Group V received 1,900mg/kg

Tissue processing and staining:

At the end of the administration, the wistar rats were humanely sacrificed by an overdose of chloroform; the skin was removed and fixed in formalin. After fixation, the skins were transferred into an automatic processor where they went through a process of dehydration in ascending grades of alcohol (ethanol) 70%, 80%, 95% and absolute alcohol for 2 changes each. The tissues were then cleared in xylene and embedded in paraffin wax. Serial sections of 5 micron thick were obtained using a rotary microtome. The tissue sections were deparaffinised, hydrated and stained using the routine haematoxylin and eosin staining method (H&E). The stained sections were examined under the light microscope fitted to a digital camera and lap top.

Results and Discussion

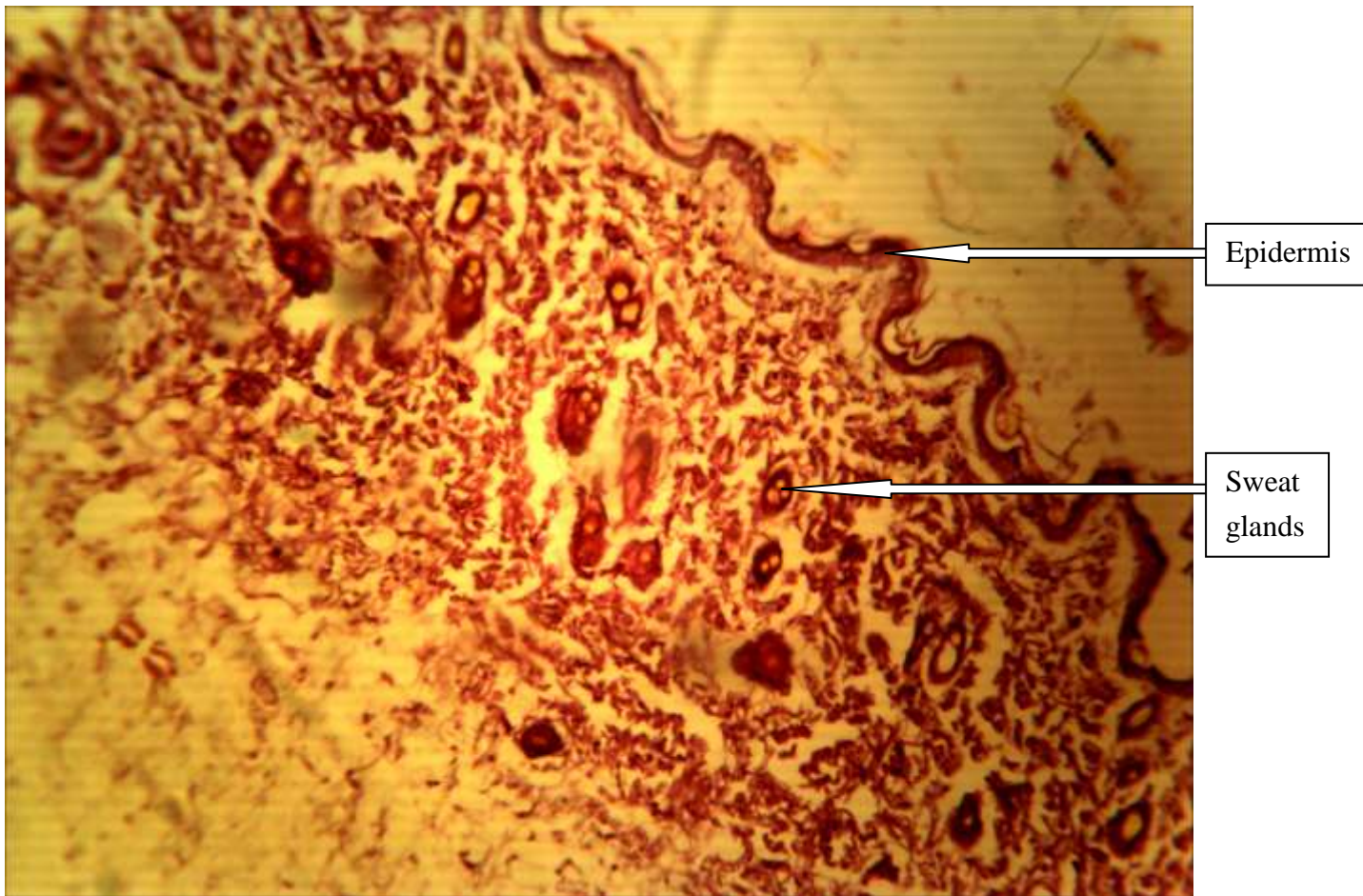


Plate 1: Photomicrograph of Skin of Wistar rats of group I Showing normal Histology of the epidermis and dermis. X100 H&E

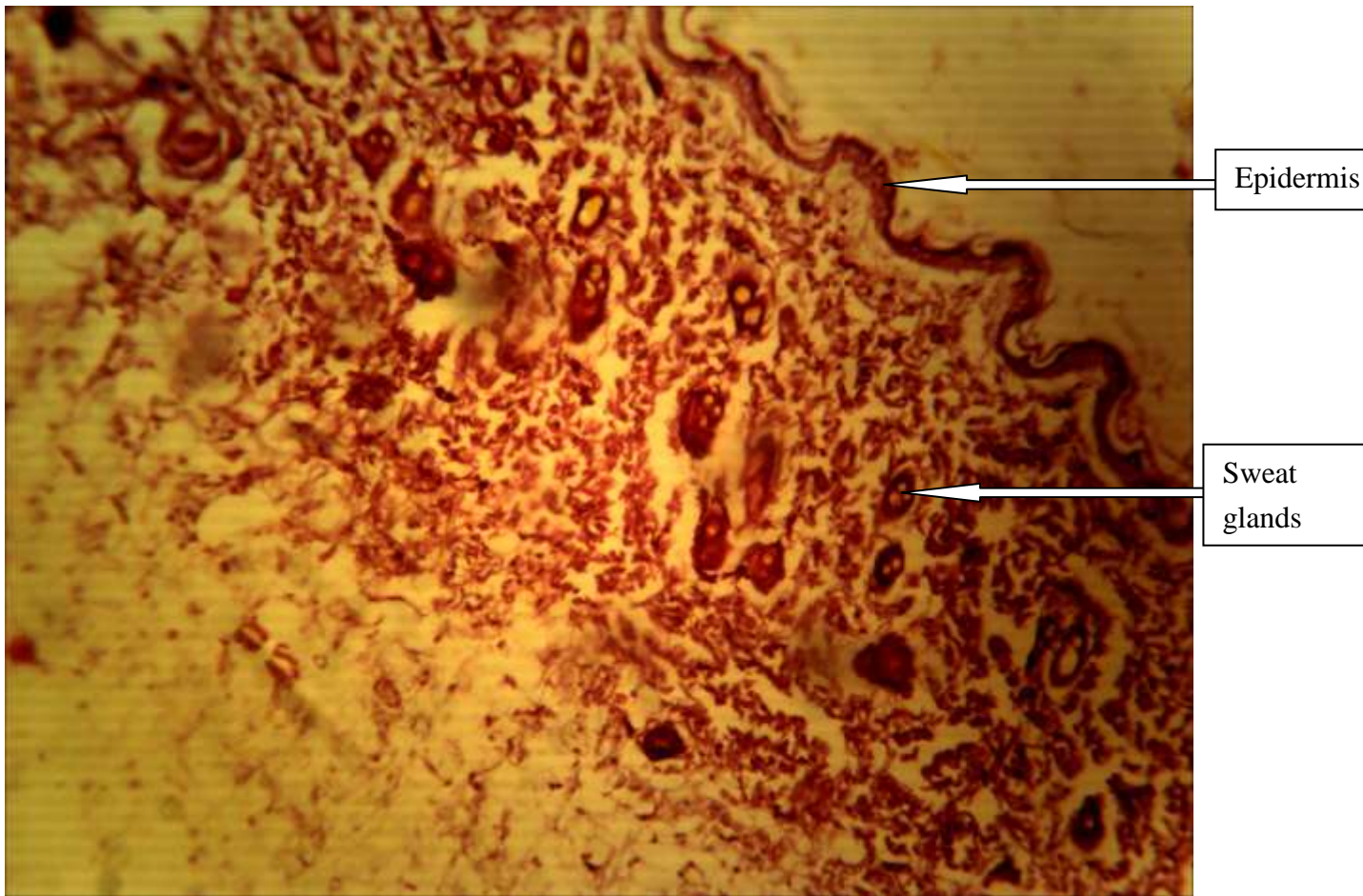


Plate 2: Photomicrograph of Skin of Wistar rats of group II Showing normal Histology of the epidermis and dermis. X100 H&E

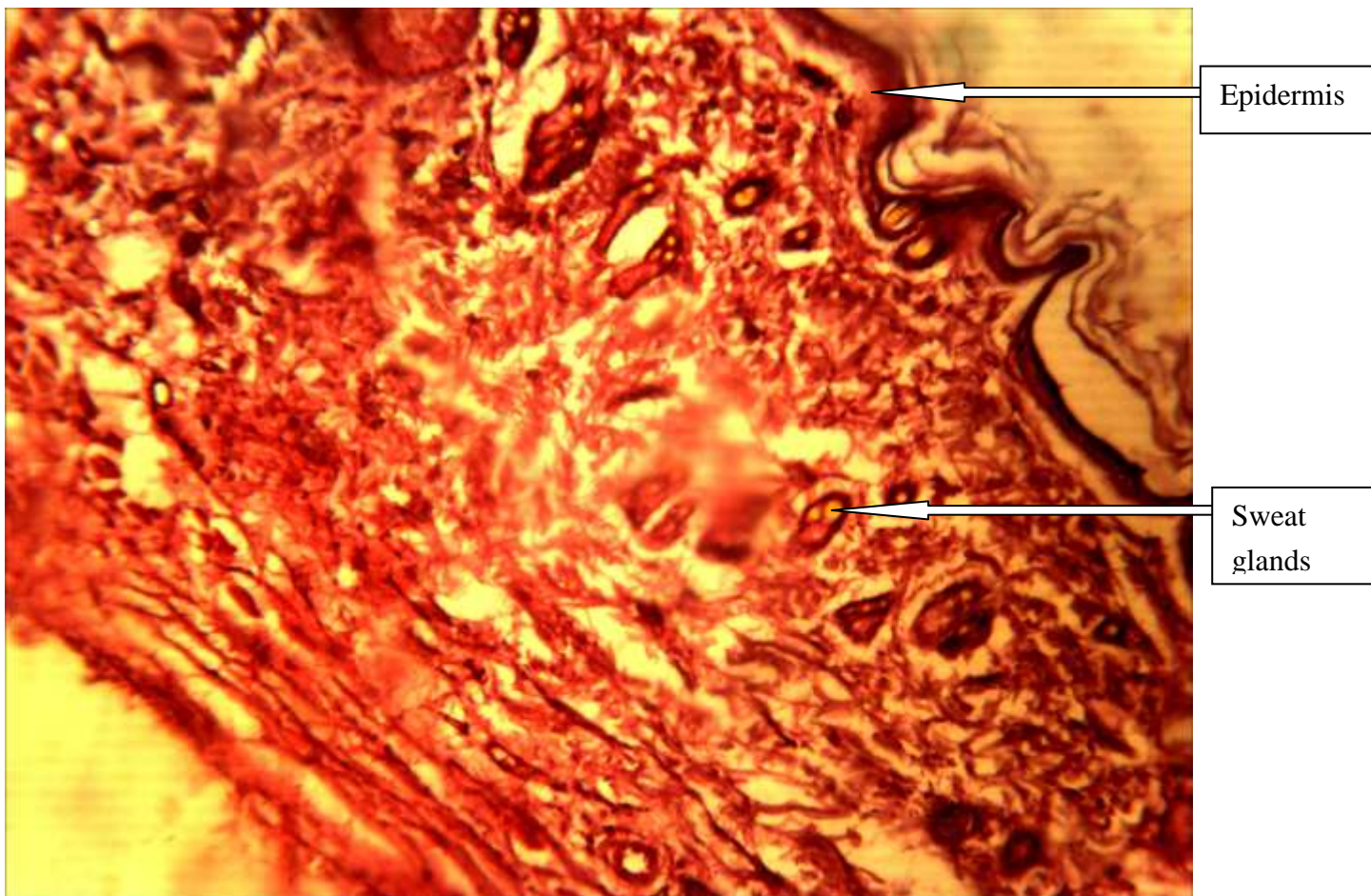


Plate 3: Photomicrograph of Skin of Wistar rats of group III Showing normal Histology of the epidermis and dermis. X100 H&E

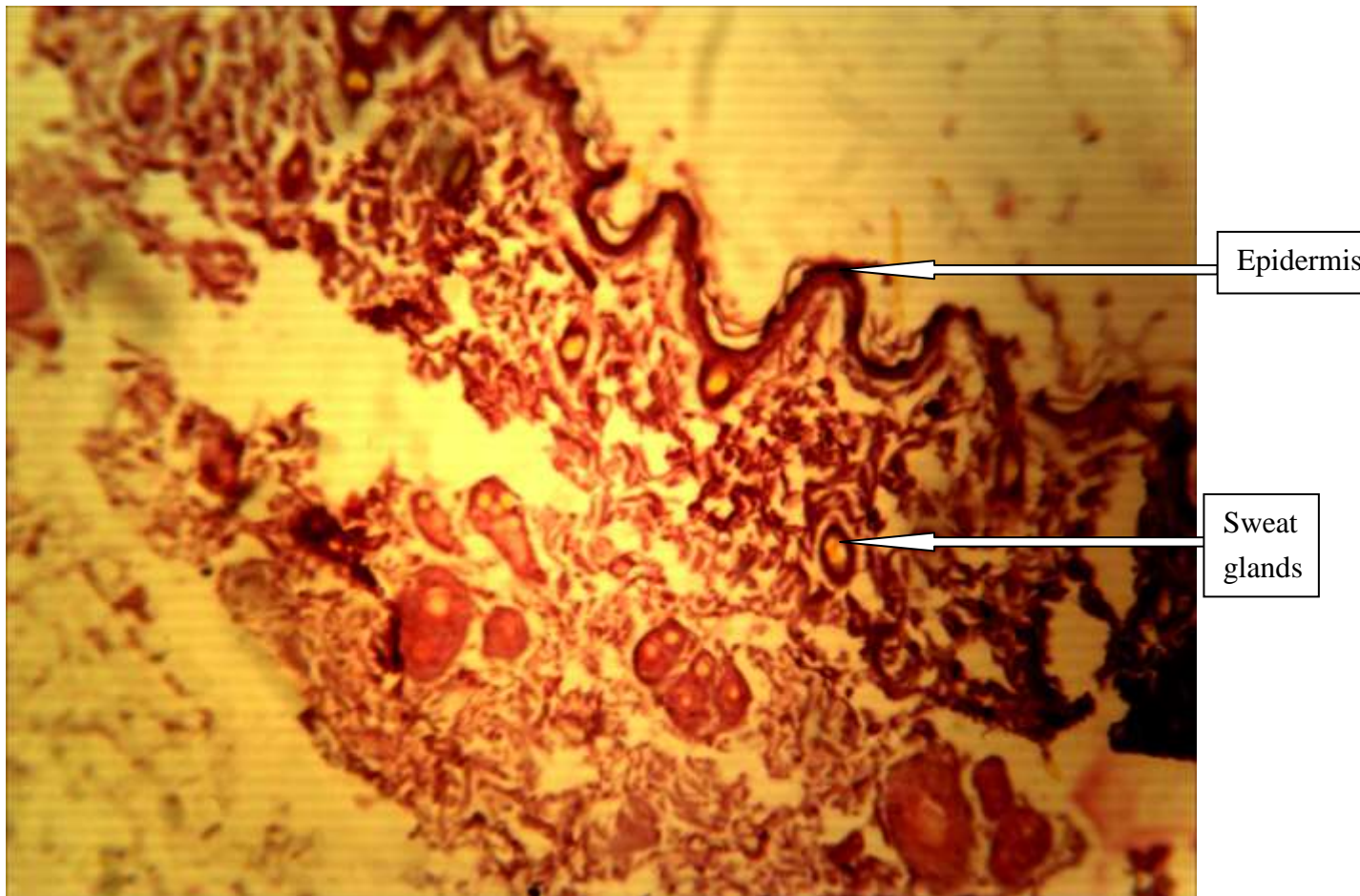


Plate 4: Photomicrograph of Skin of Wistar rats of group IV Showing normal Histology of the epidermis and dermis. X100 H&E

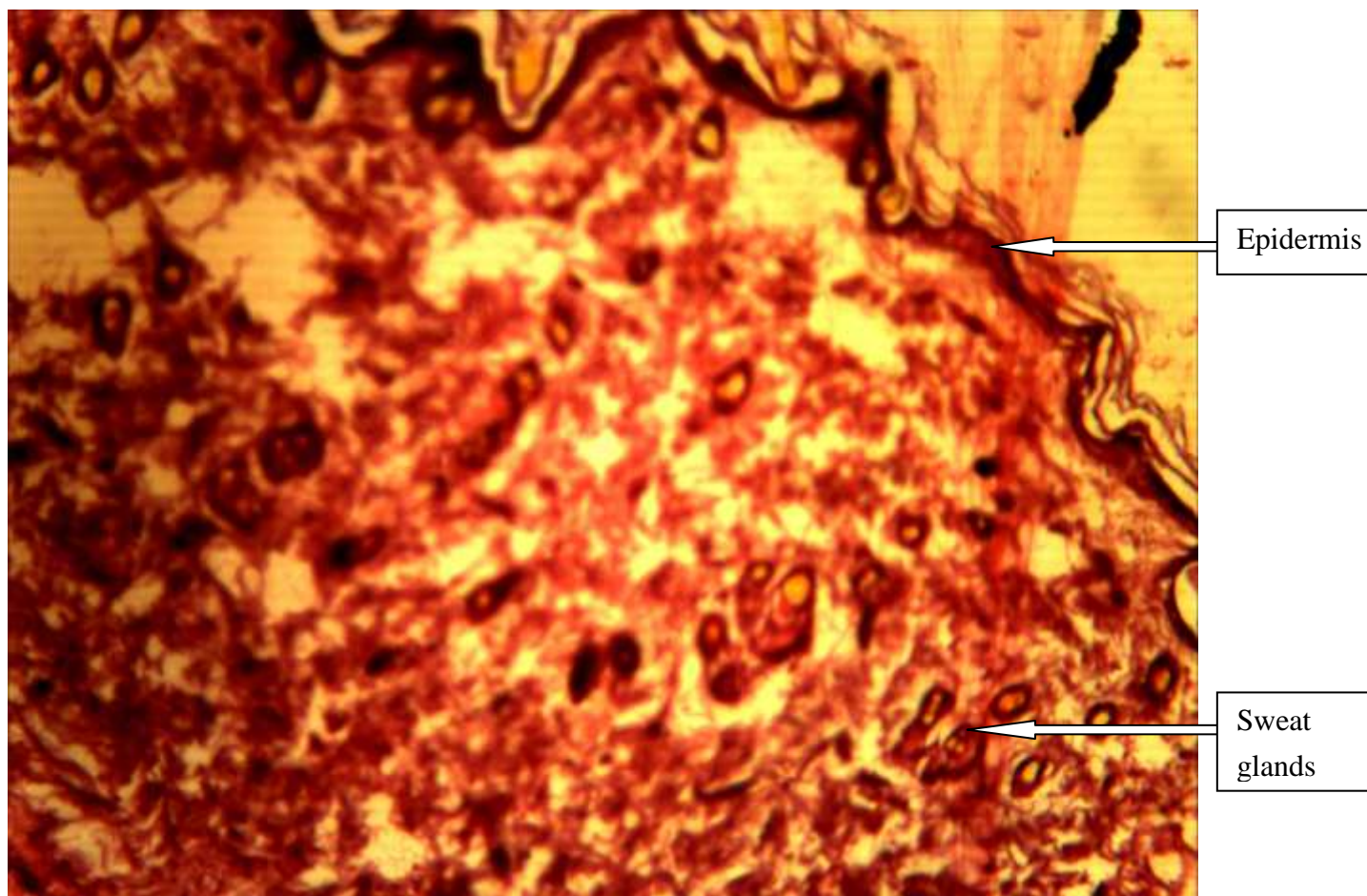


Plate 5: Photomicrograph of Skin of Wistar rats of group V Showing normal Histology of the epidermis and dermis. X100 H&E

Aluminium was said to have contributed to a variety of cognitive impairments in mice, rabbits, and rat pups (Muller *et al.*, 1990; Yoke, 1985; Bilkei-Gorzo, 1993; Mari *et al.*, 2001).

The health effects of antiperspirants are a matter of dispute regarding their extent. A small percentage of people are allergic to aluminium and may experience contact dermatitis when exposed to aluminium-containing deodorants (Abreo, 2009). Aluminium from use of deodorants caused contact dermatitis to the skin. After using a deodorant containing zirconium, the skin may develop an allergic, axillary granuloma response. Deodorant alum crystals are weak irritant to the skin. Alcohol-free deodorant is available for those with sensitive skin. It is one of the few abundant elements that appear to have no beneficial function to living cells (non-essential metal) (Exley, *et al.*, 2007). Aluminium present most often in antiperspirants, but not usually present in non-antiperspirant deodorants, has been established as a neurotoxin in very high Doses. At high doses, Aluminium itself adversely affects the blood-brain barrier, is capable of causing DNA damage, and has adverse epigenetic effects. (Lankoff, *et al.*, 2006). Research has shown that high doses of the Aluminium salts used in antiperspirants have detrimental effects to a number of species such as non-human primates, mice, and dogs. But this finding was in contrast to our observations, as our present study showed that aluminium chloride exposure had no significant deleterious effects on the histology of the skin of wistar rats, as there was no atrophy seen on the tissues. (Plates 1-V).

An increased amount of Aluminium was present in the brains of many Alzheimer's patients (Zubenko and Hanin, 1989; Banks and Kastin, 1989; Sarin, et al., 1997). Experiments with mice applying aqueous solution of Aluminium chloride to the skin resulted in "a significant increase in urine, serum, and whole brain Aluminium" and transplacental passage (Anane, et al., 1995). A study shown that the use of aluminium chlorohydrate, the active ingredient in many antiperspirants, does not lead to a significant (vs. ingestion via diet) increase in aluminium levels in the body with one-time use. This was in concord with the results of our present study that showed normal histology of the epidermis and dermis of skin of wistar rats exposed to Aluminium chloride (Plates II-V). The association between exposure to Aluminium and long term use of antiperspirants and Alzheimer's disease is a trend toward a higher risk with increasing frequency of use. The use of aluminium-containing antiperspirants has been linked with the systemic accumulation of aluminium which increases the risk of Alzheimer's disease. (Graves, et al., 1990; Anane, et al., 1997).

There is little indication that aluminium is acutely toxic by oral exposure despite its widespread occurrence in foods, drinking-water, and many antacid preparations (WHO, 1997). In 1988, a population of about 20 000 individuals in Camelford, England, was exposed for at least 5 days to unknown but increased levels of aluminium accidentally distributed to the population from a water supply facility using aluminium sulfate for treatment. Symptoms including nausea, vomiting, diarrhoea, mouth ulcers, skin ulcers, skin rashes, and arthritic pain were noted. It was concluded that the symptoms were mostly mild and short-lived. No lasting effects on health could be attributed to the known exposures from aluminium in the drinking-water (Clayton, 1989). Other reports on occupational Aluminium exposure and neurological impairments demonstrate mixed findings (Sim, et al., 1997). Despite strong experimental and clinical evidence for Aluminum neurotoxicity, the mechanism of Aluminium effects on the nervous system is still not completely clear. Our present study revealed that the skin of wistar rats of group I that received distill water only showed normal histology of the epidermis and dermis of the skin (plate I) and the Aluminium treated groups II to V that received 475mg/kg, 950mg/kg, 1420mg/kg and 1,900mg/kg respectively showed no significant changes (no atrophy observed) in the normal histology of the epidermis and dermis of the skin of wistar rats (plates II-V). From our results, we could extrapolate that oral exposure to aluminium chloride did not alter the histology of the skin and hence its functions of thermoregulation, protection, metabolic functions and sensation may not be alter by oral ingestion of aluminium chloride.

Conclusion

Our results showed that aluminium chloride exposure did not affect the histology of the skin as eminent in normal histology of the skins for both control and treated groups. Based on our observations, we therefore conclude that oral administration of Aluminium Chloride did not have any significant deleterious effects on the skin of wistar rats.

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An Examination into Relationship between Moral Judgment Competence and Psychological Symptoms of Post- Graduate Students

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Abstract

In this study, it was examined whether the relationship between moral judgment competences of postgraduate students and their psychological symptoms was significant or not. It was performed with 542 volunteer students doing their doctorate in various universities in 2009-2010 education term. As measuring instruments in the study, Moral Judgment Competence Scale was used to measure moral judgment competence and Psychological Symptom Check List (SCL-90) was used to measure psychological symptom levels. Correlation test was used as measuring method. As a result of the research, it was found that moral judgment competence was a factor for psychological symptoms and a significant relationship was found between moral judgment, and phobic anxiety and psychoticism.

Keywords: Moral judgment competence, psychological symptom, a post-graduate study

Introduction

Mental health can be defined as individual's being in harmony with self, people around and society and maintaining the required effort to keep a continuous balance, order and harmony (Köknel, 1989). Many researches have been performed on mental health. In a study conducted in Norway, it was found that university and academy students are more inclined to psychological problems compared to general population and there are symptoms of psychological disorders in 21% of students (Yemenici, 2006). Most of the postgraduate students both work in a certain job and have an academic career. They have to deal with many problems arising from professional life, while they have to face the problems of being a student. In this context, it can be said that postgraduate students are mentally in the risky group.

An individual with a decent mental health is psychologically mature. Having a democratic and moral character means showing respect for the rights of others and this is one of the most important criteria of psychological maturity. Moral judgment competence forms the basis of democratic personality (Çiftçi, 2003:44).

Moral judgment is an issue of psychological development. A morally developed individual adapts into the society he/she lives in healthily. He/she acts in accordance with standards of judgment. He/she can make a balance between own interests and needs and wills of the society. As a result, he/she develops a healthy personality (Çağdaş and Seçer, 2002:96). Fromm argues that mental health and happiness depend on moral standards of judgment, neuroses are a sign of moral failure and in many cases a neurotic sign is a special statement of a moral conflict (Fromm, 1993).

When the studies on moral judgment and psychological symptoms were examined in our country, thesis of Hatunoğlu was found. Hatunoglu (2003), compared the evaluation of university students with different moral development levels on their and society's moral level and their psychological symptom levels. When the foreign studies were checked, study of Reinhard was found. Reinhard (1990) examined 12 schizophrenia and 20 neurotic teenager patients according to moral judgment development stages of Kohlberg and found that there were significant differences in moral judgments of both groups.

In other studies, it was seen that moral judgment was associated with other variables; seen that 400 people who were university graduates constituted the sample of the study named "Values Psychology" of Güngör (1993). According to the findings, all of the subject reached to the last stage of moral development expect for 5 (all in the young males group). Güngör emphasized that developing the research in a way to represent a broader population would be more useful. Şemin (1952) worked with 291 kindergarten and primary school students in total whose ages vary between 4 and 6 in his study named "Moral Behavior and Moral Judgment in Children". Çileli (1981) examined relation between moral judgment and mental development in students at the ages of 14 – 18. Özkaynak (1982) examined the moral judgment development in children between the ages of 6-11 who studied in Teğmen Kalmaz Primary School. Koyuncu (1983) compared the gender role identity and moral development stages. In a study carried out by Koca (1987) on 120 children at the age of seven who studied in the first grade, he researched whether gender, educational background of mother, having siblings or not, going to kindergarten or not had an influence on the moral judgments of the children or not. Akkoyun (1987) found a significant relation between emotional empathy and moral judgment in his study "Empathic Tendency and Moral Judgment". Kaya (1993) did a study on moral judgments of university students according to some personal variables. Kurt (1996) studied the moral development levels and supervision focus perceptions of the counselors and teachers. Ilgar

(1996) examined the effect of supervision focus on value systems, moral development level and self-moral evaluation.

Çiftçi (2001) examined the factors affecting the moral judgment levels of Turkish high school students in Germany and Turkey and comparatively and he also compared how the students raised in two different cultures perceived their moral judgment competences and their schools as moral atmosphere. Oktay (2001) analyzed the differences between moral judgments and moral behavior intentions of people multidimensionally. Hatunoğlu (2003) compared the evaluation of university students with different moral development levels on their and society's moral level and their psychological symptom levels. Çırak (2006) compared university students' moral judgment competences and realizing levels of themselves. Çapan (2005) examined the moral developments of children at the ages of 3-11 according to moral development theory of Piaget. Demirhan (2007) examined the influence of intensive thinking training program on moral judgments of juvenile offenders. Gültekin (2008) examined influence of university education on moral judgment competence in psychology, guidance and psychological consulting students. Şafak (2008) examined the cognitive moral judgment competences of teachers and managers working in primary schools multidimensionally. Şengün (2008) examined the moral maturity levels of high school students in terms of some personal variables. Seydooğulları (2008) researched influence of democratic and strict parent attitudes on moral judgment competences of students studying in high school. Akandere et al. (2009) examined the influence of participating in sports in secondary schools on the moral development of the child. Koç et al. (2009) made a research on the moral level of interaction between university lecturers and students according to moral development theory of Kohlberg.

When the studies made abroad are examined, Kohlberg and Kramer (1969) had a research on the universality of the moral development stages. Fodor (1969) compared the moral judgments of white children group between the ages of 14 - 17 and with low socio-economic level with the moral judgment levels of black children group with the same attributes using the three stories of Kohlberg. Keasey (1971) applied the Moral Dilemma Questionnaire (MJI) of Kohlberg to a sample group consisting 75 male and 69 female students in order to examine the relations between moral stages and social participation. Haan, Langer and Kohlberg (1976) made a research whether family interaction affects the moral developments of children or not. Leming (1978) examined the relation between moral judgment and moral thinking. Turiel, Edwards and Kohlberg (1978) applied the Turkish form of MMS which is the moral dilemma questionnaire of Kohlberg in their study. Nisan and Kohlberg (1982) examined the moral developments of subjects chosen from a village and a city in Turkey. Brandon, Kerler, Killough and Mueller (2007) examined the influence of cognitive moral development on the ethical decisions of students. Ambrose, Arnaud and Schminke (2008) examined the influence of personal moral development and ethical climate on work development. Ho and Lin (2008) examined the relation between cultural values and cognitive moral developments of American and Taiwanese accounting students. Karpiak and Baril (2008) examined the relation between moral judgment and environmental attitudes on 158 university students. Sealen and Markovits (2008) researched the relation of emotion attributes and moral decisions with 373 adolescents. Frimer and Walker (2009) made a research on personal interest and moral sensibility.

Method

The study was performed with relational screening method. In the study, Moral Judgment Competence (MJC) was considered as independent variable and self- and social moral judgment level as dependent variable. For the sample of the research, 542 volunteer

postgraduate students, namely 122 from Sakarya University, 40 from Abant İzzet Baysal University, 35 from Düzce University, 32 from Ankara University, 32 from Anadolu University, 38 from Osmangazi University, 25 from Selçuk University, 25 from Niğde University, 25 from Karadeniz Teknik University, 50 from Atatürk University, 42 from Celal Bayar University, 28 from Muğla University and 48 from Ege University were determined randomly in 2009-2010 education year.

In the study, moral judgment competence scale, self-moral evaluation scale and social moral evaluation scale were used. The story used by Güngör (1981) in his research Values Psychology constituted a sample for one of the stories used by Kohlberg. Dilemma of “stealing drugs for saving life” which is one of the most known and used one of the stories was applied in this study as it is in the research of Güngör (1981). Direction: Read the following story carefully and mark the beginning of the statement conforming to the situation of the man in the story with and X. “A peasant whose wife gets sick takes her to the city and has her examined and he takes a prescription from the doctor. After paying for the doctor’s fee, he does not have any money left to pay for the drugs...”

1. However it is, theft is a crime. This man should be punished for what he has done. Of course, law will not leave him in peace. The one who robs because he needs money and the one who steals because he needs medicine are not discriminated before the justice.

5. This man saves a person from death by taking the drugs. However, the man with drugs does not have such an urgent need. Everyone should do their best to save the lives of people and justice and law concept should be based on this principle.

For the purpose of giving an idea about the content, there are 6 different judgment choices which aim to determine the reactions of the subjects in the scale a short part and choice examples of which are given above. Out of these judgments, numbers 11 and 4 reflect the pretraditional moral concept, numbers 3 and 6 reflect traditional moral concept and numbers 2 and 5 reflect the rational and critical (posttraditional) moral concept. These judgments are given in random order not to create any order effect. The subjects show a moral development stage they are in by selecting one of the judgments.

Psychological Symptom Check List developed by Derogatis et al. (1977) is a symptom scanning tool which evaluates the level of stress faced by the individual or negative stress reaction experienced. SCL-90 which is used as an inventory of making self understood in various patient groups and normal population studies is a test which consists of answers which are never (0), little (1), medium level (2), quite much (3) and extremely (4) and which tests stress levels which reveal itself with psychological symptoms, and high scores indicate psychiatric disorders. Turkish reliability study of SCL-90 which consists of 10 symptom groups which are 9 sub-items and an additional scale was performed by Dağ (1991). Sub-scales of psychological symptom check list are somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, anger-hostility, phobic anxiety, paranoid ideation, psychoticism and additional items. Techniques used for analysis of data and their reasons are given as follows.

Table 1. Data Analysis Techniques and Reasons

Data Analysis Method	Reason
Frequency and Percentage	To describe the existing situations as they are
Correlation	To determine whether independent variable is a factor or not for dependent variable

Findings

Findings on the Relationships between Moral Judgment Level and Psychological Symptoms

Table 1. F Test Results on the Relationships between Moral Judgment Level and Psychological Symptoms

		N	Mean	Std. Deviation	df	KO / KT		F	Sig.
						Mean Square	Sum of Squares		
Self-moral value	Pre Tradition	62	,82	,75	2	,040	,08		
	Traditional Level	409	,84	,64	539	,415	223,90	,10	,91
	Post Tradional	71	,80	,60	541		223,98		
	Total	542	,83	,64					
Society Moral Value	Pre Tradition	62	1,22	,70	2	,026	,05		
	Traditional Level	409	1,24	,62	539	,408	220,13	,06	,94
	Post Tradional	71	1,22	,67	541		220,19		
	Total	542	1,23	,64					
somatization	Pre Tradition	62	,89	,76	2	,410 ,453	,82		
	Traditional Level	409	1,01	,67	539		244,15	,91	,41
	Post Tradional	71	,95	,63	541		244,97		
	Total	542	,99	,67					
Obsessive -Compulsive Disorder	Pre Tradition	62	1,00	,84	2	,273	,55		
	Traditional Level	409	1,09	,67	539	,491	264,57	,56	,57
	Post Tradional	71	1,02	,71	541		265,12		
	Total	542	1,07	,70					
Interpersonal Sensitivity	Pre Tradition	62	,80	,76	2	,115	,23		
	Traditional Level	409	,74	,58	539	,368	198,16	,31	,73
	Post Tradional	71	,73	,59	541		198,39		
	Total	542	,75	,61					
Depression	Pre Tradition	62	,82	,69	2	,037	,07		
	Traditional Level	409	,78	,64	539	,418	225,17	,09	,92
	Post Tradional	71	,79	,63	541		225,24		
	Total	542	,79	,65					
Anxiety	Pre Tradition	62	,55	,75	2	,479	,96		
	Traditional Level	409	,43	,49	539	,269	145,21	1,78	,17
	Post Tradional	71	,40	,44	541		146,17		
	Total	542	,44	,52					
Hostility	Pre Tradition	62	1,00	,78	2	,125	,25		
	Traditional Level	409	1,04	,68	539	,473	254,98	,26	,77
	Post Tradional	71	,98	,62	541		255,23		
	Total	542	1,03	,69					
Phobic Anksiyete	Pre Tradition	62	,66	,72	2	,126	,25		
	Traditional Level	409	,62	,52	539	,299	161,43	,42	,66
	Post Tradional	71	,57	,54	541		161,68		
	Total	542	,62	,55					
Paranoid Thought	Pre Tradition	62	,89	,68	2	,041	,08		
	Traditional Level	409	,89	,51	539	,284	153,06	,14	,87
	Post Tradional	71	,85	,53	541		153,15		
	Total	542	,88	,53					

Test Statistics^{a,b}

	somatization	Obsessive-Compulsive Disorder	Interpersonal Sensitivity	Depression	Anxiety	Hostility	Phobic Anxiety	Paranoid Thought	Psychotic	General Mental Health
Chi-Square	10,615	6,369	11,919	8,135	13,281	9,779	13,958	8,324	13,504	14,109
df	5	5	5	5	5	5	5	5	5	5
Asymp. Sig.	,060	,272	,036	,149	,021	,082	,016	,139	,019	,015

^a Kruskal Wallis Test

^b Grouping Variable: STAGES

The relationship between moral judgments and psychological symptoms of postgraduate students is given in table 1. Accordingly, a significant relationship was found between moral judgment and phobic anxiety. Phobic anxiety shows difference in 2nd stage and 3rd stage which are moral judgment stages. A significant relationship was found between moral judgment and psychoticism. Psychoticism shows difference in 3rd stage and 4th stage which are moral judgment stages.

Conclusion and Discussion

Moral judgment competence is a factor for psychological symptoms.

A significant relationship was found between moral judgment and phobic anxiety, phobic anxiety shows difference in 2nd stage and 3rd stage which are moral judgment stages. In addition, a significant relationship was found between moral judgment and psychoticism, psychoticism shows difference in 3rd stage and 4th stage which are moral judgment stages. Hatunoğlu (2003) could not find a significant relationship between moral development levels and scores obtained from short symptom inventory in the study on university students. This result does not support our research. Reinhard (1990) examined 12 schizophrenia and 20 neurotic teenager patients according to moral judgment development stages of Kohlberg and it was seen that there were significant differences in moral judgments of both groups. The obtained results support the result of our research. Moral judgment competence is effective on psychological disorders.

According to the findings of our research, the reason why phobic anxiety affects 3rd stage of moral judgment competent stages can be explained as follows: others are really important for the individual in the 3rd stage, actions to make others pleased are correct and the individual tries to be good in the eyes of other people. Evaluations of other people are important also in social phobia, in this sense, it is considered that social phobia affects 3rd stage of moral judgment competence stages.

The reason why psychoticism affects 4th stage of moral judgment competent stages can be explained as follows: it is important to obey the social system and social order for the individual in the 4th stage. Psychotic patients live difficulty in adapting to society and experience confusion in social relations. In this context, it is considered that psychoticism affects 4th stage of moral judgment competence stages.

Suggestions

- Awareness whether there is a consistency between the level they perceive their moral judgment competences and their behaviors should be raised in the postgraduate students.

- Postgraduate students should be given responsibilities for exhibiting exemplary behaviors for the society regarding how the rules and laws can be changed.
- Units where postgraduate students get psychological help should be established within the institute.
- In selecting postgraduate students, moral judgment competence level should be a determinant factor.
- Research on the subject can be carried out within the individuals in different professions.
- Researches may be carried out on the subjects at what ages moral judgment competence should be gained and what should be done to gain moral judgment levels.
- Moral development stages of individuals with psychological symptoms of pathological level can be examined.

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Enlightened self interest and philanthropic activities by private firms

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Abstract

We discuss expenditure on philanthropic activities by private firms as corporate social responsibility. Philanthropic activities can be rationalized as “enlightened self interest” to maximize long-term profit, as well as maximization of their own objective other than profit. Private firms doing philanthropic activities can be categorized as two different types. One is a type of firms with constant amount of philanthropic expenditure, and the other one is a type of firms with constant rate of philanthropic expenditure. For each type, we discuss effects of change in opportunity cost of philanthropy, and of preferential tax measures, using micro-economic models. We also derive an optimal pay-out ratio for the stockholders. Then we formulate a dynamic model and discuss trend of philanthropy over the time.

Key words: enlightened self-interest, philanthropy, investment, payout-ratio, tax

1. Introduction

In this paper we discuss expenditure on philanthropic activities by private firms as corporate social responsibility. Philanthropic activities by profit seeking firms can be rationalized as “enlightened self interest” to maximize long-term profit, as well as maximization of their own objective other than profit. Shiozawa (1995) shows that lower the time preference rate for private firms, higher the philanthropic activities as corporate strategies to maximize long-term profit.

In many cases, goods or services supplied as philanthropic activities are categorized as merit good or quasi-public good. For consumers, it does not matter that what kind of organization supplies these goods. Only price and quality may matter for consumers.

Using micro economic models, Feldstein(1975) discusses effects of tax deduction on donation by households. Yamauchi (1997) analyzes behavior of NPO, philanthropy and individual donors, discusses effects of tax deduction on donation, and is also surveying economic models on nonprofit behavior.

Mann (2006) defines merit goods as goods for which government interference with the aggregate willingness to pay increases utility. The arguments are based on asymmetric information, multiple preference order within one person, and externalities. In general, private firms have a lot of information on customers to make profit, so that they could be able to provide differentiated merit goods, which are suitable for diversified preferences of consumers.

Stiglitz (2000) defines paternalism as the view that the government intervene because it knows what is in the best interest of individuals better than they do themselves. Hatta (2009) points out that inefficiency caused by individual failure is less than inefficiency caused by paternalistic policies by public sectors in general. So that most of so-called merit goods should be supplied by the private sector.

Yamauchi (1997) shows that US firms tend to stabilize amount of donation expenditure where as Japanese firms tend to stabilize rate of donation expenditure to income. Indeed “1% club” in Japan is a group of firms, which have such ideas. According to Federation of Economic Organization of Japan (Keidanren) (2010, 2011), average percentage of philanthropic expenditure to current profit of member companies is between 1.38~3.47% for 1990~2010. For recent 5 years, average ordinary profit is 47.82 billion yen in 2006, 46.67 billion yen in 2007, 17.88 billion yen in 2008, 27.56 billion yen in 2009, and 37.18 billion yen in 2010 while average ratio of philanthropic expenditure to ordinary profit is 2.18% in 2006, 1.42% in 2007, 1.87% in 2008, 2.57% in 2009, and 1.81% in 2010, and average philanthropic expenditure is 0.46 billion yen in 2006, 0.47 billion yen in 2007, 0.47 billion yen in 2008, 0.44 billion yen in 2009, and 0.39 billion yen in 2010. While ordinary profit fluctuates drastically because of exogenous shocks, amount of philanthropic expenditure is relatively stable. Hence some Japanese firms tend to stabilize amount of philanthropic expenditure.

Ibuki (2005) points out that there is a paradigm shift of philanthropy from “charity” to “investment to society”. Managers of firms have accountability to stockholders. They have to explain return on philanthropic expenditure, since stakeholders such as stockholders, consumers, personnel and local community are diversified. And philanthropic expenditures are divided into two parts, one is proportional to ordinary profit and the other is stays constant despite ordinary profit.

Therefore we would say that trends of philanthropic expenditure by profit seeking firms can be categorized as constant rate of philanthropy and as constant amount of philanthropy.

In this paper, we define objective function of a firm, so that philanthropy, as well as ordinary investment, will make future profit. One reason why philanthropy makes future profit is that customers evaluate the firm and raise the demand for products of the firm. Another reason is that firms with higher philanthropy are well-evaluated in labor market so that they can more easily hire high quality labor. We introduce assumptions on the objective function, which correspond with constant rate of philanthropy or with constant amount of philanthropy. And in each case we analyze the behavior of firms theoretically.

In section 2, we formulate a problem such that given a certain amount of monetary fund a firm determines investment and philanthropic expenditure to maximize its objective function under two different assumptions on the objective function. And we also derive the optimal pay-out ratio for the stockholders.

In section 3, we discuss effects of preferential tax measures on philanthropy. We show that the effects are different according to constant rate of philanthropy and constant amount of philanthropy.

In section 4, we formulate a discrete time dynamic model. We extend the maximization problem of a firm so that given the amount of profit and dividend in the previous period, a firm determines investment and philanthropic expenditure to maximize its objective function in current period. And we discuss trend of philanthropy over the time.

2. The model

Consider a problem such that given a certain amount of money fund, say retained earnings, a firm determines investment I and philanthropic expenditure P to maximize its objective function $f(I, P)$. Let R be the amount of profit the firm has earned, and let a be the pay-out ratio for the stockholders. Then the problem is formulated as follows.

$$\begin{aligned} \max & f(I, P) \\ \text{s.t.} & I + P = (1 - a)R \end{aligned} \quad (1)$$

When $f(I, P)$ is differentiable, the first order condition for (1) is

$$\frac{\partial f}{\partial I} = \frac{\partial f}{\partial P} \quad (2)$$

This is a general condition such that marginal effects of investment and philanthropic expenditure on the objective function are equalized.

2-1. Firms with constant amount of philanthropy

We introduce the following assumption on $f(I, P)$ to specialize the function.

Assumption 1. $f(I, P) = v(P) + bI$

$$v'(P) > 0, v''(P) < 0, b > 0$$

That is, we specialize the objective function as quasi-linear. We assume that the marginal productivity of investment is constant and the marginal productivity of philanthropy is decreasing.

The first order condition (2) is now

$$v'(P) = b \quad (3)$$

If marginal productivity of investment is constant, optimal amount philanthropic expenditure is constant whatever the total amount of available fund. We denote the amount of philanthropic expenditure, which satisfies condition (3) as follows.

$$\bar{P} \equiv v^{-1}(b) \quad (4)$$

The value of \bar{P} depends on the productivity of investment. Then we can derive the following proposition.

Proposition 1. Under Assumption 1, optimal amount of philanthropic expenditure is constant whatever available fund is, and decreases as marginal productivity of investment increases.

Increase in marginal productivity of investment implies increase in opportunity cost of philanthropy, since a certain amount of fund is allocated on investment and philanthropy. Philanthropic expenditure decreases as opportunity cost of philanthropy increases. And when total amount of fund changes by some reason, philanthropic expenditure stays constant for this type of objective function.

So far, we think that pay-out ratio a is given. Then we derive an optimal pay-out ratio for stockholders. Let R_0 be an amount of retained earnings, so that $(1-a)R_0$ can be used as either investment or philanthropy to make profit in next period. Let ρ be the rate of time preference of stockholders, so that dividend in the previous period is discounted by ρ . And we assume $R_0 > \bar{P}$. Then the dividend maximization problem for the stockholders can be formulated as follows.

$$\max . aR_0 + \rho a \{v(\bar{P}) + b[(1-a)R_0 - \bar{P}]\} \quad (5)$$

The first order condition is

$$R_0 + \rho \{v(\bar{P}) + bR_0 - 2abR_0 - \bar{P}\} = 0 \quad (6)$$

Then by solving for a , we can derive an optimal pay-out ratio for the stockholders.

$$a = \frac{R_0 - \bar{P}}{2\rho bR_0} + \frac{v(\bar{P})}{2bR_0} + \frac{1}{2} \quad (7)$$

Hence we can derive the following proposition.

Proposition 2. Under Assumption 1, the higher the discount factor ρ (that is, the lower the rate of time preference) and marginal productivity of investment, the lower the optimal pay-out ratio for the stockholders.

2-2. Firms with constant rate of philanthropy

We introduce the other assumption on the objective function to specialize as Cobb-Douglas production function.

$$\text{Assumption 2. } f(I, P) = qP^c I^{1-c} \\ q > 0, 1 > c > 0$$

Here q denotes productivity. Under Assumption 2, the first order condition (2) becomes

$$\frac{\partial f / \partial I}{\partial f / \partial P} = \frac{1-c}{c} \frac{P}{I} = 1 \quad (8)$$

We can derive optimal amounts of philanthropy and investment as follows.

$$P = c(1-a)R, I = (1-c)(1-a)R \quad (9)$$

Hence we can derive the following proposition.

Proposition 3. Under Assumption 2, the ratio of philanthropic expenditure to total fund stays constant as total fund changes, and the ratio of philanthropic expenditure to total fund decreases as technical rate of substitution of investment to philanthropy $\frac{\partial f / \partial I}{\partial f / \partial P}$ increases.

As in the previous section, philanthropic expenditure decreases as opportunity cost of philanthropy increases. However philanthropic expenditure increases as total amount of available fund increases for this type of objective function.

As in the case of Assumption 1, we derive the optimal value of pay-out ratio a for stockholders. Under Assumption 2, dividend maximization problem for stockholders is as follows.

$$\max . aR_0 + \rho a \{ q [c(1-a)R_0]^c [(1-c)(1-a)R_0]^{1-c} \} \quad (10)$$

The first order condition is

$$R_0 + \rho q c^c (1-c)^{1-c} R_0 - 2a\rho q c^c (1-c)^{1-c} R_0 = 0 \quad (11)$$

Hence an optimal pay-out ratio for stockholders is

$$a = \frac{1}{2\rho q c^c (1-c)^{1-c}} + \frac{1}{2} \quad (12)$$

Therefore we can derive the following proposition.

Proposition 4. Under Assumption 2, the higher the discount factor ρ (that is, the lower the rate of time preference) and marginal productivity of investment, the lower the optimal pay-out ratio for the stockholders.

3 . Effects of preferential tax measures

We discuss effects of tax system on philanthropy. Let D be dividend to stockholders, and τ be rate of corporation tax. When there are no preferential tax measures, the budget constraint of a firm is as follows.

$$\begin{aligned} (1-\tau)R &= P + I + D \\ &= P + I + aR \end{aligned} \quad (13)$$

$$(1-\tau-a)R = I + P$$

In this case, the relative price of philanthropy and investment does not change whatever the rate of corporation tax. The total amount of the fund decreases by the amount of corporation tax.

When tax exemption is introduced on philanthropic expenditure, we have the following budget constraint.

$$\begin{aligned} (R-P)(1-\tau) &= I + D \\ &= I + aR \end{aligned} \quad (14)$$

$$\left(1 - \frac{a}{1-\tau} \right) R = \frac{1}{1-\tau} I + P$$

In this case, the relative price of philanthropy and investment is changed. That is, the opportunity cost of philanthropy is changed.

The first order condition (2) becomes

$$\frac{\partial f / \partial I}{\partial f / \partial P} = \frac{1}{1 - \tau} \quad (15)$$

3-1. Firms with constant amount of philanthropy

Under Assumption 1, the first order condition (3) becomes

$$v'(P) = (1 - \tau)b \quad (16)$$

And philanthropic expenditure, which satisfies the first order condition (16), is

$$\bar{P} \equiv v'^{-1}(b) < v'^{-1}[(1 - \tau)b] \equiv \bar{P}' \quad (17)$$

Then we have the following proposition.

Proposition 5. Under Assumption 1, when corporation tax without any exemption is imposed, expenditure on investment decreases whereas philanthropic expenditure stays constant. When tax exemption is imposed on philanthropic expenditure, philanthropic expenditure increases, and effect on expenditure on investment is indeterminate. Under tax exemption on philanthropic expenditure, as the rate of corporation tax increases, philanthropic expenditure increases and expenditure on investment decreases.

When tax exemption on philanthropic expenditure is introduced, philanthropic activity is relatively low-priced than investment, and the real value of available fund is increased, so that philanthropic expenditure increases by a positive substitution effect. Under Assumption 1, an income effect does not work on philanthropic expenditure. Since investment is relatively high-priced, the substitution effect of tax exemption on philanthropic expenditure on investment is negative and the income effect is positive, so that the total effect is indeterminate. Under tax exemption on philanthropic expenditure, as the rate of corporate tax increases, the substitution effect on philanthropic expenditure is positive, and both the substitution effect and the income effect on expenditure on investment are negative.

3-2. Firms with constant rate of philanthropy

Under Assumption 2, the first order condition (15) is

$$\frac{\partial f / \partial I}{\partial f / \partial P} = \frac{1 - c}{c} \frac{P}{I} = \frac{1}{1 - \tau} \quad (18)$$

so that the optimal amount of philanthropy and investment are denoted as follows.

$$P = \frac{c(1 - \tau - a)}{1 - \tau} R, \quad I = (1 - c)(1 - \tau - a)R \quad (19)$$

From (19) we have

$$\frac{\partial P}{\partial \tau} = \frac{-cR(1 - \tau) + c(1 - \tau - a)R}{(1 - \tau)^2} \quad (20)$$

$$\frac{\partial I}{\partial \tau} = -(1 - c)R < 0 \quad (21)$$

Then we have the following proposition.

Proposition 6. Under Assumption 2, when corporation tax without any exemption is imposed, expenditure on investment and philanthropic expenditure decrease. When tax exemption is imposed on philanthropic expenditure, philanthropic expenditure increases, and the effect on expenditure on investment is indeterminate. Under tax exemption on philanthropic expenditure, as the rate of corporation tax increases, expenditure on investment decreases and the effect on philanthropic expenditure is indeterminate.

As in section 3-1, when tax exemption on philanthropic expenditure is introduced, philanthropic activity is relatively low-priced than investment, and the real value of available fund is increased, so that philanthropic expenditure increases by the positive substitution effect and the positive income effect. Since investment is relatively high-priced, the substitution effect of tax exemption on philanthropic expenditure on investment is negative and the income effect is positive, so that the total effect is indeterminate. Under tax exemption on philanthropic expenditure, as the rate of corporation tax increases, the substitution effect on philanthropic expenditure is positive and the income effect is negative since philanthropic activities becomes relatively low-priced, so that the total effect is indeterminate. And both the substitution effect and the income effect on expenditure on investment are negative, since investment becomes relatively high-priced.

4. Dynamic Analysis

Consider a discrete time model. We extend the maximization problem (1) so that given the amount of profit and dividend in period $t-1$, a firm determines investment $I(t)$ and philanthropic expenditure $P(t)$ to maximize its objective function $f[I(t), P(t)]$ in period t . Here $f[I(t), P(t)]$ is the amount of profit in period t . The problem is formulated as follows.

$$\begin{aligned} \max. & f[I(t), P(t)] \\ \text{s.t.} & I(t) + P(t) = (1-a)f[(I(t-1), P(t-1))] \end{aligned} \quad (22)$$

4-1. Firms with constant amount of philanthropy

The objective function under Assumption 1, the problem (22) is as follows.

$$\begin{aligned} \max. & v[P(t)] + bI(t) \\ \text{s.t.} & I(t) + P(t) = (1-a)\{v[P(t-1)] + bI(t-1)\} \end{aligned} \quad (23)$$

Since the optimal philanthropic expenditure is \bar{P} by (3), the optimal investment $I(t)$ in period t is denoted by the profit $v(\bar{P}) + bI(t-1)$ in the previous period minus \bar{P} and the dividend D , that is, $v(\bar{P}) + bI(t-1) - \bar{P} - D$. When we denote as $a' \equiv 1 - a$, then we have the following first order linear difference equation.

$$I(t) = a'bI(t-1) + a'v(\bar{P}) - \bar{P} \quad (24)$$

General solutions of difference equation (24) can be divided into following cases depending on coefficient $a'b$.

4-1-1. Case of $a'b = 1$

A general solution of (24) is

$$I(t) = \{a'v(\bar{P}) - \bar{P}\}t + I(0) \quad (25)$$

In (25) $a'v(\bar{P}) - \bar{P}$ is the net profit from philanthropy. Time paths of optimal investment are different depending on the amount of $a'v(\bar{P}) - \bar{P}$ in (25).

(i) Net profit from philanthropy is zero: $a'v(\bar{P}) - \bar{P} = 0$

In this case, investment in each period is always equal to initial investment $I(0)$.

(ii) Net profit from philanthropy is positive: $a'v(\bar{P}) - \bar{P} > 0$

In this case, profit from philanthropy is used to invest, therefore investment and profit increase as time goes on.

(iii) Net profit from philanthropy is negative: $a'v(\bar{P}) - \bar{P} < 0$

In this case, profit from investment is used on philanthropy, therefore investment and profit decrease as time goes on.

4-1-2. Case of $a'b \neq 1$

A general solution of (24) is

$$I(t) = \frac{a'v(\bar{P}) - \bar{P}}{1 - a'b} + \left\{ I(0) - \frac{a'v(\bar{P}) - \bar{P}}{1 - a'b} \right\} (a'b)^t \quad (26)$$

Time paths of optimal investment are different depending on the amount of $a'v(\bar{P}) - \bar{P}$ in (26).

(i) Net profit from philanthropy is zero: $a'v(\bar{P}) - \bar{P} = 0$

A general solution is

$$I(t) = I(0)(a'b)^t \quad (27)$$

If the coefficient is $a'b > 1$, investment and profit increase as time goes on.

If the coefficient is $a'b < 1$, investment and profit decrease as time goes on.

(ii) Net profit from philanthropy is positive: $a'v(\bar{P}) - \bar{P} > 0$

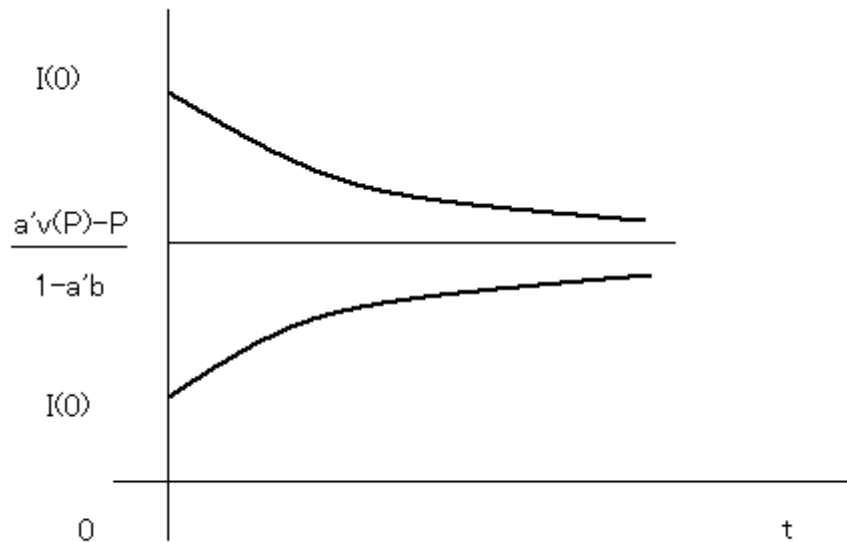
If the coefficient is $a'b > 1$, investment and profit increase as time goes on for any initial value $I(0)$ of investment.

If the coefficient is $a'b < 1$, time paths of optimal investment and profit depend on initial value $I(0)$ of investment.

If initial value $I(0)$ of investment is $I(0) > \frac{a'v(\bar{P}) - \bar{P}}{1 - a'b}$, investment and profit decrease, and investment approaches to $\frac{a'v(\bar{P}) - \bar{P}}{1 - a'b}$ as time goes on.

If initial value $I(0)$ of investment is $I(0) < \frac{a'v(\bar{P}) - \bar{P}}{1 - a'b}$, investment and profit increase, and investment approaches to $\frac{a'v(\bar{P}) - \bar{P}}{1 - a'b}$ as time goes on.

Figure 1. Case of positive net profit from philanthropy and $a'b < 1$



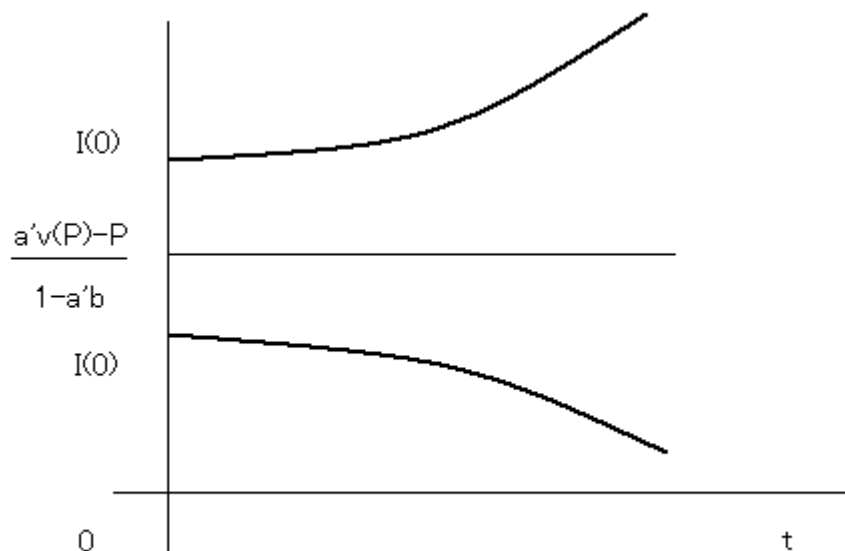
(iii) Net profit from philanthropy is negative: $a'v(\bar{P}) - \bar{P} < 0$

If the coefficient is $a'b > 1$, time paths of optimal investment and profit depend on initial value $I(0)$ of investment.

If initial value $I(0)$ of investment is $I(0) > \frac{a'v(\bar{P}) - \bar{P}}{1 - a'b}$, investment and profit increase as time goes on.

If initial value $I(0)$ of investment is $I(0) < \frac{a'v(\bar{P}) - \bar{P}}{1 - a'b}$, investment and profit decrease as time goes on.

Figure 2. Case of negative net profit from philanthropy and $a'b > 1$



If the coefficient is $a'b < 1$, investment and profit decrease as time goes on with any value of initial investment $I(0)$.

4-2. Firms with constant rate of philanthropy

Under Assumption 2, the problem (22) becomes as follows.

$$\begin{aligned} \max . \quad & qP(t)^c I(t)^{1-c} \\ \text{s.t.} \quad & P(t) + I(t) = (1-a)R(t-1) = (1-a)qP(t-1)^c I(t-1)^{1-c} \end{aligned} \quad (28)$$

Optimal amounts of investment and philanthropy in each period are

$$\begin{aligned} P(t) &= ca'qP(t-1)^c I(t-1)^{1-c} \\ I(t) &= (1-c)a'qP(t-1)^c I(t-1)^{1-c} \end{aligned} \quad (29)$$

So that the ratios of investment and philanthropy to profit stay constant as time goes on. By (29) the growth rate of these variables is

$$\begin{aligned} \frac{R(t)}{R(t-1)} &= \frac{a'q[cR(t-1)]^c [(1-c)R(t-1)]^{1-c}}{R(t-1)} \\ &= a'qc^c (1-c)^{1-c} \\ &= (1-a)qc^c (1-c)^{1-c} \end{aligned} \quad (30)$$

Hence the growth rate is greater than 1, that is, the net growth rate is positive, if the pay-out ratio satisfied the following condition.

$$a < 1 - \frac{1}{qc^c (1-c)^{1-c}} \quad (31)$$

That is, under Assumption 2, the higher the productivity q , the greater the possibility of positive growth of philanthropy and profit.

5. Concluding remark

We formulate philanthropy by profit seeking firms as means to get profit based on enlightened self-interest as well as ordinal investment, in cases of constant rate of philanthropy and constant amount of philanthropy. In both cases, philanthropic expenditure decreases as opportunity cost of philanthropy increases. And the higher the discount factor (that is, the lower the rate of time preference) and marginal productivity of investment, the lower the optimal pay-out ratio for the stockholders.

Preferential tax measures on philanthropy increase philanthropic expenditure in both cases. Under preferential tax measures on philanthropy, when corporation tax rate is raised, philanthropic expenditure increases in the case of constant amount of philanthropy, while the effect is indeterminate in the case of constant rate of philanthropy, since the substitution effect and the income effect have opposite sign.

When we formulate a dynamic model, where given the amount of profit and dividend in the previous period a firm determines investment and philanthropic expenditure to maximize its objective function in current period, we have different time paths in these two cases. In the case of constant amount of philanthropy, the optimal investment is denoted by first order linear difference equation, and its time path depends on pay-out ratio and net profit from philanthropy. In the case of constant rate of philanthropy, the optimal investment and

philanthropic expenditure vary at constant rate, which depends on pay-out ratio and productivity.

As stated above, philanthropy as enlightened self-interest depends on pay-out ratio, productivity and tax system. Formulation of more general objective function other than profit, and discussion on applications to empirical data deserve further research.

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Developing TVET Teachers for Meeting the Demands of Sustainable Development on Curriculum Tasks

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Abstract

With barely two years to the end of the United Nations Decade of Education for Sustainable Development (2005-2014) the expected culture of sustainability is yet to be established in most developing countries. This may be due to lack of political will on the part of the leaders to create enabling environment for sustainability education or lack of knowledge and skills on the part of teachers and educationists to develop and implement education for sustainable development curriculum. This presentation intends to bring to the fore salient issues that need to be repositioned in teacher development, especially with regards to Technical and Vocational Education and Training (TVET) teachers to ensure effective implementation of education for sustainable development curriculum. After conceptual issues, the discussion highlights the areas that TVET teachers need professional development and takes a step further in justifying each area of need.

Keywords: Sustainability, Technical and Vocational Education and Training, Curriculum, Professional Development, Task Performances.

1. Introduction

The concept of sustainable development was introduced at the United Nations General Assembly in 1987. Subsequent deliberations on global affairs continued to project education as a veritable tool for sustainable development. These deliberations include the 1992 United Nations Conference on Environment and Development (the Earth Summit in Rio de Janeiro) during which Education for Sustainable development (ESD) was first described in chapter 36 of Agenda 21; the 1997 International Conference on Environment and Society; Education and Public awareness for sustainability; the 2002 World Summit on Sustainable Development in Johannesburg, during which the United Nations Decade of Education for Sustainable Development (ESD) spanning from 2005 to 2014 was proposed and adopted at the 57th United Nations general Assembly.

These and other similar conferences and seminars demonstrate the United Nations leadership position in the introduction and promotion of ESD. Nations all over the world are also making concerted efforts to reorient their educational endeavours towards sustainable development. One fact emerging from these conferences and seminars is that education constitutes a veritable tool for achieving sustainable development. If education is a tool for achieving sustainable development, then teachers who deliver education should be prepared to align their curriculum tasks to meet the demands of sustainable education. The thrust of this paper is to explore some issues relevant to teacher development in implementing sustainable education curriculum in Nigeria.

2. Sustainable Development and Education for Sustainable Development (ESD).

Sustainable development is a topical subject with many facets. It focuses on continuous improvement of systems, resources and information that are central to national development. It implies the type of development that enables the present generation to enjoy good life with no potential problems for the future generation. In this regard, sustainable development hinges on three interdependent and mutually reinforcing pillars namely environment, society and economy (UNESCO, 2006). A healthy environment (clean environment with adequate water supply, good refuse disposal etc) breeds a healthy society where good economy thrives. Consequently, sustainable development covers environmental protection, social development and economic development. These components of sustainable development are aimed at human development which is the main target of education for sustainable development.

In this regard, education for sustainable development (ESD) implies the education that equips the learner with the knowledge and skills to make positive choices with regards to the society, the environment and the economy. Such knowledge and skills enable the learner to take actions to improve on the quality of life in such a way that the improvement does not in any way impair the ability of future generation to enjoy quality of life. In this regard it gives the learner a sense of responsibility in creating a future that is sustainable. In other words ESD is concerned with knowledge and actions that can result in sustained quality of life for the present and the future. It is concerned with knowledge, skills, values and attitudes with regards to environmental sustainability, economic sustainability and social sustainability. The knowledge dimension involves knowledge of sustainability, equity, rights and responsibilities as well as social justice among others while among the education for sustainable development skills are skills of listening to people, collaboration, empathy, conflict resolution and decision making. ESD goes beyond formal education to encompass non-formal and informal educational sectors. This is because it is both lifelong (from birth till death) and life-wide (covering all aspects of life), involving everybody both young and old. ESD is also interdisciplinary as well as integrative in the sense that it brings together elements in different school subjects and

combines all human activities with learning. Consequently ESD equips the learner with knowledge, skills, values and perspectives to enjoy quality of life with respect for other people and the environment. In fact ESD develops in learners attitude and behaviours that promote a culture of sustainability. This is based on the fact that the goals of ESD are to develop in learners the ability to participate in the establishment of equitable and just society as well as the ability to communicate and live harmoniously with people and nature. These overriding goals of education for sustainable development (ESD) can be achieved through the teaching and learning of different school subjects. In this regard, values and respect for people of the present and future generations as well as value for the environment and the planet we exist in are the bedrock of ESD curriculum. The concept of ESD has not only cognitive but also moral, ethical and spiritual dimensions which require a shift in people's attitudes and behaviours so as to promote sustainable development in the society. A close look at the following four major directions for implementing ESD as presented by UNESCO (2006) shows that instruction in every school subject should be geared towards ESD. These directions are:

- Improving access to quality basic education.
- Reorienting existing education programmes.
- Developing public understanding and awareness of sustainability.
- Providing training.

These four directions present a comprehensive guide to any person that wants to implement ESD at different levels. For instance, while improving access to quality basic education may concern the government more than an individual, reorienting existing education programmes concerns education practitioners and teachers more than the government. In any case, these four directions provide a beacon for ESD development, implementation and evaluation.

The present discussion is limited to the expected curriculum tasks of Technical and Vocational Education and Training (TVET) teachers with regards to the implementation of ESD. It has been observed in this communication that every school subject can present ESD to learners. However, it appears that Technical and Vocational Education and Training (TVET) can play a major role in the promotion of ESD. This is because TVET refers to

those aspects of the educational process involving, in addition to general education, the study of technologies and related sciences, and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupation in various sectors of economic and social life. (UNESCO,2001: p.7).

This UNESCO presentation reveals that TVET is a component of education every learner should acquire; it involves the study of technologies and sciences as well as the acquisition of occupation based practical skills, knowledge and attitudes. It is a poverty alleviating, lifelong and life-wide methodology. Consequently, by nature, TVET is sustainable development oriented because it covers the three components of sustainability- environment, society and economy. These basic characteristics of TVET indicate that its effective instruction can assist the nation to achieve the long aspired goal of sustainable development. In this regard, the next section of our discussion focuses on the required strategies to be adopted by TVET teachers in curriculum task performance so as to ensure that TVET instruction contributes to the achievement of the goals of ESD.

3. Curriculum and Education for Sustainable Development (ESD)

Basically, curriculum is concerned with what is taught, how it is taught and extent of achievement of educational goals of the society. Despite the many different ways people view the curriculum, in the present communication curriculum is conceived as all educational efforts geared towards the overall development of the learner and the well being of the society. The goal is to equip the learner with appropriate knowledge, skills and attitude to contribute effectively to life in the society. Over the years, appropriate knowledge and skills have been presented as being encapsulated in the three Rs namely, Reading, wRiting and aRithmetic. However, developments in information and communication technologies (ICTs) are resulting to changes in all aspects of life activities including the curriculum. Consequently, the twenty-first century curriculum is not only concerned with the development of abilities in the three Rs but in the other Rs that are necessary for effective life in a fast changing society. Among these other Rs which the curriculum must aim to develop are Reasoning, Resilience and Responsibility (Sternberg 2008). Sternberg affirms that these latter three Rs do not replace but complement and enhance the first three. The twenty-first century curriculum is not only present subject matter to the learners but must also develop in the learners reasoning abilities (including critical thinking and analytical abilities), resilience (such as flexibility, self-reliance and adaptability), responsibility (including social competence, respectful relationships), among others. This implies that the twenty-first century curriculum is concerned with the learning content, personal development of the learner, the society (social competence) and the environment (adaptability). This underlines the close relationship between the twenty-first century curriculum and education for sustainable development. This type of curriculum is implemented from the point of view of sustainable development. In this regard, all components of the curriculum such as the instructional objectives, the content, methodology and evaluation are selected and implemented with the aim of achieving sustainable development in the society. The selection and implementation of these components of curriculum constitute a major aspect of the curriculum tasks of the teacher. To respond to the requirements of ESD, each curriculum component is developed and implemented with a view to equipping learners with knowledge, skills and attitudes in different subject areas as well as the capacity to integrate learning into societal, economic and environmental endeavours. The TVET teachers' curriculum tasks performances in integrating these demands of sustainable development in curriculum development and implementation are discussed in this communication with reference to the five types of curriculum existing in most schools. These are the official or documented curriculum, the operational or implemented curriculum, the implied curriculum, the void curriculum and the extended curriculum.

3.1 TVET Teachers' Official/Documented Curriculum Tasks Performances.

In Nigeria, the official curriculum is prepared at the national and state levels and consequently schools obtain copies of these documents from Federal and State Ministries of Education. Except for a few teachers that may participate at the curriculum development and review workshops at the state and national levels, teachers who are the chief curriculum implementers do not perform any significant curriculum task at this level. However, teachers study and interpret the curriculum document in line with the culture and philosophy of the school. This type of study reveals aspects of the national curriculum to be emphasized and aspects with alternative elements. For instance while implementing the same national curriculum, teachers in deferent parts of the country implement the national policy on language education differently in the sense that the language to be considered mother tongue or language of immediate environment depends on the geographical location of the school.

Despite such elements of choice in the official/documented curriculum, the TVET teachers' major curriculum tasks performances at this level constitute in upholding the official curriculum. In this era of information and communication technologies (ICTs) in which new knowledge is generated very fast as people make effort to understand and use these ICTs. This implies that new learning contents are continuously being generated. Despite this availability of new knowledge, the TVET teachers are required to continue to teach the official curriculum pending the time it is reviewed. They have to ensure that there is no gap between the official/documented curriculum and the implemented curriculum.

3.2 TVET Teachers' Operational/Implemented Curriculum Tasks Performances

The classroom TVET subject teachers are key factors in curriculum implementation because they select and set up the learning opportunities which are meant to enable the learners acquire desired knowledge, skills, and values articulated in the curriculum. The fact that a curriculum has been so well designed to feature appropriate experiences is no guarantee that corresponding appropriate experiences would result. The type of educational experiences that will result in the end will depend on the TVET subject teachers. Curriculum implementation involves using appropriate modes of content delivery, giving and marking assignments, giving feedback, modeling, using inquiry and soliciting advice and opinions, giving praise and directing students' classroom processes (Blasé & Blasé, 2004).

The task of curriculum implementation also involves the implementation of curriculum policies and innovations. In doing this, the teacher is expected to use a variety of resources, and give students directives that may be necessary for the demands of the instructional process. Curriculum tasks performances in this area involve every practice of instructional leadership concerning textbook prescriptions and resources allocation. In delivering the curriculum, TVET subject teachers are charged with teaching pupils in the assigned classrooms and of various grades or years. They plan, implement and evaluate lessons. It is also among the job of TVET subject teachers to define lesson objectives, specify instructional alternatives and select from among alternatives to enhance instructional effectiveness.

Implicit in these descriptions of TVET subject teachers' roles in curriculum delivery is the fact that it is concerned with the ability of the teacher to display sound skills in setting instructional objectives, classroom management, instructional delivery, and evaluation, which are very essential in determining the quality of what the students are taught. By effective performance of their curriculum delivery tasks, TVET subject teachers are more likely to prepare their learners for future contributions to sustainable management of schools.

The demands of sustainable development imply that the curriculum be implemented from sustainable development perspective. In this regard, the TVET teachers are to adopt instructional strategies that are not only geared towards facilitating the learning of school subjects but are also directed to promoting the goals of education for sustainable development (ESD). This requires the use of integrative approach to curriculum implementation in which the objectives, concepts, as well as learning experiences for sustainable development are integrated in all aspects of curriculum implementation. ESD also involves the use of interdisciplinary curriculum implementation approach which enables learners to integrate ideas from different subject areas during the learning process instead of dealing with knowledge that is compartmentalized in different subjects. It is necessary to note that teaching for sustainable development does not imply a redefinition of educational goals rather it provides a good avenue for achieving these educational goals without overloading the curriculum.

The implementation of TVET curriculum for ESD also requires the use of learner-centered and problem-based instructional approaches. In this regard, UNESCO (2010) presents the following as ESD teaching and learning strategies:

1. **Experiential learning:** Using this instructional strategy, teachers engage students in activities that have relevance to activities in their lives. This instructional strategy helps students to develop “critical thinking, problem solving and decision making in contexts that are personally relevant to them” (UNESCO, 2010, p.8).
2. **Storytelling:** This involves appropriately integrating storytelling into the teaching units. This strategy is aimed at developing appreciation and skills in the instructional use of storytelling.
3. **Values education:** The development of values and attitudes is related to the affective domain of educational objectives. The aim of this instructional strategy is to develop an understanding and skills in different strategies for values education.
4. **Enquiry learning:** This instructional strategy is used to develop the skills of thinking and problem solving which are important skills for sustainable development. TVET teachers need to possess skills in the planning, implementation and assessment of enquiry-based instruction.
5. **Appropriate assessment:** ESD requires evaluation strategies that integrate assessment with the process of teaching and learning. Also teachers need to develop skills in assessing knowledge, skills, attitude and values in ESD.
6. **Future problem solving:** This strategy enables learners develop skills for analyzing and solving a problem. They learn the steps and strategies in identifying a problem, its causes and effects as well as possible solutions.
7. **Learning outside the classroom:** This strategy involves the use of learning opportunities outside the classroom to promote ESD. These opportunities include different forms of in-school activities, excursions to relevant places such as factories, gardens, black smith’s workshop, lakes etc.
8. **Community problem solving:** This strategy enables learners understand how problems are solved in the community. Participation in the solution of community-based problems equips learners with the skills and abilities to solve problems in their local environment. This strategy is also good for developing knowledge and skills of good citizenship.

Effective TVET curriculum implementation for sustainable development demands that teachers are knowledgeable and skilled in these ESD instructional strategies. The use of these strategies can promote the development of knowledge, skills and values dimensions of the ESD objectives. Our next line of discussion is on the curriculum tasks performances of TVET teachers in the area of implied curriculum.

3.3 TVET Teachers’ Implied-Curriculum Tasks Performances

Implied-curriculum refers to all the undocumented and unofficial school routines and activities through which students acquire knowledge, attitude and behaviours that are not as a result of the intended learning experiences. This type of curriculum includes all the unplanned learning experiences which learners acquire during the implementation process of the official/documented curriculum. It can be interpreted as the side effect of both the official and implemented curricula. It constitutes of the unintended messages that learners acquire from the official/documented and implemented curricula. For instance, scheduling of subjects on the

school time table gives learners the message that some subjects are more important than the others. In a situation where learners have English and Mathematics lessons every school day whereas another subject such as French language is presented only two times in a week, it is implied that English language and mathematics are more important than French language.

Though the implied-curriculum is the unintended result of the documented and implemented curricula, it plays significant roles in determining the extent of achievement of the goals of the official/documented and implemented curricula. This is because it presents to learners the norms, values and beliefs inherent not only in the classroom but also in the social environment and consequently shapes the attitude of learners to the official/documented and implemented curricula. Also the implied-curriculum plays strategic roles in the socialization process and in enabling the learner deal with the official/documented and the implemented curricula. In this regard the implied-curriculum can promote or discourage the achievement of objectives of the official/documented and implemented curricula. While positive messages promote learning, negative messages discourage learning. It is through the implied-curriculum that some students learn truancy and other antisocial behaviours.

The fact that the messages of the implied-curriculum are concerned with values, attitudes, beliefs and behaviours shows that this type of curriculum constitutes a significant aspect of TVET teachers' curriculum tasks performances. Teaching for sustainability demands that TVET teachers implement the curriculum in such a way that only positive elements in the implied-curriculum is promoted while the negative elements are discouraged. Since the implied-curriculum is concerned with behaviour and attitude, the teacher has to be careful not only in the implementation of the official/documented curriculum but also in the messages learners get from how the teacher talks, dresses and behaves. Teaching for sustainability demands that teachers demonstrate the beliefs, attitudes, values and behaviours they expect the learners to manifest.

3.4 TVET Teachers' Void-Curriculum Tasks Performances

Curriculum development involves considerations of learning possibilities and taking decisions on what the learner must learn and can learn. During this development process, some elements are left out or made void while others are selected and developed to constitute the curriculum. These ideas that are left out either because the school system cannot teach them due to logistic reasons or the curriculum planners consider them not as important as the selected elements, are referred to as void-curriculum. This is the untaught curriculum. It is the totality of human experiences that are intentionally left out from the curriculum. The effective implementation of education for sustainable development demands that teachers recognize that the curriculum does not cover all possible human learning and should approach curriculum delivery or implementation with openness. Education for sustainable development requires Technical and Vocational Education and Training (TVET) teachers to think carefully about what is not in the curriculum as much as they think about what the curriculum presents.

3.5 TVET Teachers' Extended-Curriculum Tasks Performances

This is another area of teacher curriculum task performance. Technical and Vocational Education and Training (TVET) subject teachers are expected to perform other functions not stipulated in the curriculum but that are crucial to teaching and learning. These functions constitute the extended-curriculum tasks of the teacher. Though they are not specifically a part of the documented and the implemented curricula, they play a major role in determining the extent of achievement of the goals of these two curricula. For instance, a teacher that is willing to participate in extended-curriculum activities is punctual in school attendance, strives to

enforce and manifest disciplined behaviours, and shows commitment to the general welfare of the school. He/ she is judicious in preparing his /her lesson notes, keeping the classroom in order, disciplining his/pupils pupils, evaluating pupils learning outcomes, participating in school committees, attending and contributing to staff meetings and Parents TVET subject Teachers Association meetings. Such a teacher also participates in the planning of school extended-curriculum activities and shows serious efforts in assisting in school administration. Other extended-curriculum tasks include the organization of debates, excursions, inter-house competitions, and many others. The extent to which the TVET subject teachers perform these tasks is one of the focus areas of this discussion.

For learners to develop sustainability knowledge and skills as well as manifest the values, behaviours and lifestyles that are necessary for sustainable development, one of the tasks of the TVET teachers is to inject elements of sustainable development ,not only into all instructional activities but also in all extended-curriculum activities. Education for sustainable development requires teachers to view every extended-curriculum activity as an avenue to direct the attitude, behaviour and value systems of learners towards sustainable development. Through the use of extended- curriculum activities, teachers strive to promote ethics and values that are responsive to cultural identity, democratic decision-making, respect for others and the planet. Exposing learners to sustainability elements in and out of the classroom ensures that they live sustainably in their schools and wider communities.

One strategy for integrating education for sustainable development into extended-curriculum activities is the adoption of whole-school approach to sustainability in which all aspects of the school are directed to sustainability. In this regard, the curriculum, administrative strategies, the learners and staff as well as elements of the implied- curriculum are consistent with the principles and practice of sustainability. In fact, the whole-school approach to sustainability integrates sustainability into the school curriculum in such a way that what is learnt in the classroom is reinforced by sustainability messages learned in the entire school environment including playground, refectory and even school directed extended curriculum activities outside the school environment.

In the preceding sections of this discussion we have tried to examine the concept of education for sustainable development (ESD) and the Technical and Vocational Education and Training (TVET) teachers' ESD required curriculum tasks performances with regards to the official or documented curriculum, the operational or implemented curriculum, the implied-curriculum, the void-curriculum and the extended-curriculum. The TVET teachers' ability to perform these curriculum tasks depends on their professional knowledge, skills and values of sustainable development. Unless they are sustainability oriented in their personal and professional activities they cannot develop the required sustainability abilities in the learners. Our next discussion focuses on the required professional development of TVET teachers for the development and implementation of curriculum for sustainable development

4. Professional Development Needs of TVET Teachers

The present Technical and Vocational Education and Training (TVET) curriculum is largely textbook driven while appropriate TVET curriculum for ESD is thematic, project-based and integrated. Skills and content are not taught as an end in themselves, but they are learnt through practice. In this regard, teachers who entered the profession with the knowledge of teacher-centered- textbook-lecture based curriculum can neither develop nor implement a curriculum for sustainable development. The way out is for these teachers to avail themselves to professional development through which they can acquire the sustainability competences they are expected to develop in the learners. In this regard, teachers need continuous

professional development for them to develop attitudes, values and dispositions that are in congruent with ESD. Through professional development, teachers achieve development in knowledge, issues, skills, perspectives and values which are the five domains of sustainable development competences presented by UNESCO. Apart from acquiring knowledge in areas such as sustainability, equity, peace, rights, responsibilities and social justice, through professional development, teachers deepen their education for sustainability development skills of listening to others, collaboration, empathy, conflict resolution, decision making, esteem building, critical analysis, discussing and arguing effectively, detecting and challenging bias and stereotyping, democratic leadership and taking risk (Inman, 2002). Also the Comenius 2-1 project report (Sleurs,2008) lists knowledge, systems thinking, emotions, ethics and values as well as actions as the five domains of competences that teachers need to develop for the implementation of education for sustainability development. Though a detailed discussion on each of these competences is beyond the scope of this discussion it is necessary to state that the development of these competences through professional development is a *sin qua non* for the effective implementation of education for sustainable development curriculum.

Technical and Vocational Education and Training (TVET) teachers also need to acquire knowledge on how to implement the thematic, integrated ESD curriculum. UNESCO Draft Framework in Pratchett (2010) identified the following ten key themes of education for sustainable development: overcoming poverty, gender equality, health promotion, environmental protection and conservation, rural transformation, human rights, intercultural understanding and peace, sustainable production and consumption, cultural diversity, and information and communication technologies. These themes cannot be covered by any single subject of instruction but each is to be implemented across the curriculum. This indicates that TVET teachers need knowledge, skills and dispositions to implement such a thematic curriculum and integrate sustainability in all aspects of the curriculum. The required knowledge, skills and attitudes can be acquired through appropriate programme of professional development. It is only through professional development that teachers can acquire knowledge and skills necessary for the development of creative thinking, problem solving, decision making, analysis, co-operative learning, leadership, and communication skills in the learners. A summary of the needed areas of teachers' professional development is presented in Table 1.

Table 1: Needed Areas of Teachers' Professional development

S/N	Needed Areas	Justification
1.	Concept and principles of sustainability and education for sustainable development (ESD).	Teachers cannot implement education for sustainable development (ESD) curriculum unless they understand the key concepts in and rationale for this aspect of knowledge and are willing to learn, teach and demonstrate sustainability-oriented education.
2.	ESD skills.	Teachers need to develop in themselves and be able to develop in the learners skills in the 6Cs, namely critical thinking, creative thinking, collaboration, cooperation, conflict management civic participation and other ESD skills.
3.	ESD instructional strategies	Teachers need to learn how and when to use a host of learner-centered approaches and experiential learning strategies that can enable them deliver authentic education that involves the mind, body and spirit (the whole person). Teachers also need to learn how to practice interdisciplinary teaching and learning as well as how to integrate ESD into the entire learning process.
4.	ESD Attitude and values	Teachers need to learn positive attitude and values such as care for the environment, respect and consideration for all living beings, tolerance as well as manifesting a democratic mind set.
5.	ESD themes	Acquiring knowledge, skills and understanding in relation to ESD themes will enable teachers integrate the relevant knowledge, skills and attitude in the different school subjects and in non-formal learning encounters. Based on the knowledge of the ESD themes, teachers can create a sustainability learning environment in and out of the classrooms.
6.	Information and communication technologies (ICTs).	Teachers need the knowledge and skills to use ICTs for the integration and presentation of ESD

Professional development in this discussion covers in-service as well as continuous professional development of serving teachers which may be in form of seminars, conferences and in-service short-term and longer-term courses. Apart from equipping TVET teachers with sustainability knowledge, skills and attitudes and the competences presented in Table 1, it is expected that professional development programmes for TVET teachers take cognizance of the

following criteria for good TVET teachers and trainees as presented by International Labour Organization (ILO, 2010).

- extensive knowledge in one or more subjects or fields of learning;
- a high degree of functionality in ICT and technological processes;
- general understanding and ability to share larger economic and social realities with students;
- capacity to impart generic learning skills to students through their instruction and organization of learning processes;
- ability to function collaboratively in a team;
- research, reflection and change as necessary in teaching practice (teacher as learner);
- ability to communicate and empathize with students;
- capacity to innovate and impart innovation in learning. (ILO, 2010,p.19)

Integrating these criteria for good TVET teachers into professional development programme of this group of teachers ensures that both new and in-service TVET teachers are prepared to teach for sustainability and in the process equip their learners with twenty-first century skills. These skills are closely related to those of sustainability and the ILO criteria for good TVET teachers.

While noting that the implementation of ESD necessitates a change in the teachers' traditional tasks of teaching, instructing and communicating, Sleurs (2008) observes that "visioning and creating new perspectives are important tasks because the transformative role of education is a key issue in ESD" (p. 27). As teachers engage in their professional activities they reflect on what has happened and use the new ideas to generate other ideas and solutions. The need for TVET teachers to be equipped through professional development with the knowledge, skills and attitudes necessary for sustainability education cannot be over emphasized.

5. Conclusions

Preparation for effective life in the present twenty-first century that is dominated by fast developments in information and communication technologies (ICTs), requires the exposure of every learner to education for sustainable development. This calls for a paradigm shift from education for mere content acquisition to education for redirection of values, attitudes and behaviors to sustainable elements in the society, economy and the environment. This shift in instructional emphasis is engineering instructional endeavours to ensure that sustainability elements are appropriately integrated into the instructional process, linking one subject of instruction to the other and what is learnt in the school to life activities in the society. It is in this line that TVET is moving from the zone of providing occupation-based training to cover all aspects of workforce development especially with regards to the provision of lifelong learning. In this regard, TVET teachers need appropriate professional development to enable them perform competently their sustainable development-based tasks.

Our discussions earlier in this communication on school-based sustainability education shows that effective education for sustainable development is school-based in which every aspect of teaching and learning, as well as administration, is done with sustainability dimension. Strategies can be put in place to ensure that sustainability elements in different subject areas, in different learning encounters and in different learning situations are integrated and reinforced

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Soil Lead Composition and Distribution along Zaria – Sokoto Highway in Northern Nigeria

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Abstract:

Studies in recent times have persistently focused on hazards arising from air pollution which unarguably menaces both the physical and chemical composition of the whole atmosphere, the solid earth and by extension, the biological equilibrium of the entire earth. Soil has been observed to be the final sink for all particulate matter arising in the atmosphere. In this research work, the composition and distribution of soil lead from vehicle exhausts was investigated along Zaria – Sokoto highway where the average daily traffic density was about 7000 vehicles. The energy dispersive x-ray fluorescence (EDXRF) spectrometry technique was used for sample analysis. Samples were taken in the dry harmattan and rainy seasons from both parallel and perpendicular transects of the road and analyzed for lead concentration as a function of depth and distance from the road. Results indicated a decrease in soil lead concentration with depth. Lead was found to concentrate in the top 10cm of the soil layers, leaching being enhanced only in soluble form. The result of the entire work showed a minimum soil lead concentration of about 35.4ppm and a maximum of about 119.8ppm. The lead concentration measured along the parallel transects were between 246% and 480% of the mean background soil lead concentration. It was also observed that the soil lead concentration decreased with increasing distance from the road. The mean concentration of lead in the soil by the roadside was about 111.23 ± 0.02 ppm on the left and 103.93 ± 0.01 ppm on the right. At a distance of about 250m from the road, the mean soil lead concentration was about 55.73 ± 0.02 ppm, and 55.65 ± 0.01 ppm on the left and right respectively. The solubility of lead and depth of water table were suspected to be responsible for the downward movement (leaching) while the wind speed and direction were the main factors responsible for the transfer to greater distances from the road. The results of the rainy season investigation revealed that lead concentrations reduced to background levels after a substantial amount of rainfall of about 877.4mm. This is an indication that surface deposits existed principally as removable deposits.

Key words: Lead, Pollution, Hazards, Vehicle Exhausts.

Introduction

Research works in recent times have persistently drawn attention to hazards arising from air pollution, which unarguably disturb and modify both the physical and chemical composition of the whole atmosphere and by extension, the biological equilibrium of the entire earth (Kovacs, 1985). Pure air is that which does not, at any point in time, exert a detrimental impact on plants, animals or man. Unfortunately, this does not exist anywhere. Air indeed is polluted.

Emissions from vehicle exhausts are a steady source of air pollution that pose a great danger to the public and hence, a source of worry to environmentalists. Nigeria is one of those countries that are still using leaded gasoline as fuel for cars and other gasoline using engines (New Nigeria Newspaper, Dec., 2003 – Jan., 2004).

Air pollutants can exist in form of Organic gases (e.g. SO₂, H₂S, HCl, O₃), Organic particulates (e.g. pollen, fly-ash, smuts), or inorganic particulates (e.g. lime, metal oxides, trace or heavy elements like Pb, Cd, Hg, As etc.). Though heavy metals are found in very little or no amount in human species, they are becoming more widely present in our environment to a level that calls for serious concern. Lead, for instance, which is of no biological significance to man constitutes the greatest body burden (Botkin and Keller, 1998).

On daily basis, millions of men, women and children are exposed to lead that come out of vehicle exhausts. Sure, we cannot eliminate pollutants in its entirety or put all the lead back into the earth and cover them up. At best, we can find better ways to evaluate them in our air, soil, water, food, etc; learn more about where we get exposed to them, and work towards reducing their presence and hence, exposure. The main area of concern is the creation of awareness of and protection against these inherent dangers. Monitoring levels of trace elements and other pollutants in our environment is therefore important in assessing human exposure and environmental degradation.

Materials and Methods

Materials

The X-ray spectrometer used is a system with an in-built 25mCi ¹⁰⁹Cd annular source and a Si(Li) detector which has a resolution of 170eV for the 5.90keV line.

Instrumentation

The system comprised of an excitation source (¹⁰⁹Cd) that emits Ag-K x-ray (22.1keV) in which all elements having characteristic energies lower than that quoted above were detectable in the samples. The x-rays were excited through the sample by primary radiation and they penetrated the sample on their way to the detector. The detector was in turn coupled to a computer-controlled analog-to-digital converter (ADC) card. There was also the molybdenum (Mo) target which served a dual purpose of producing monochromatic x-rays and absorption correction. The absorption factor thus determined was then used by the software package (AXIL-QXAS) to quantify the concentration of the elements in the samples. The software was also used to correct for the contribution of the Zr-K to the Mo-K peak by subtraction. The spectra for the samples were collected for 3000s and subsequently evaluated.

Sample Collection

(a) **Soil Samples:** At each of the four sampling locations (Kwangila, Samaru, Shika, and Giwa), a depth profile of the soil comprising of samples from depths of 0, 20, 40, 60 and 80cm was carried out. The samples were collected using a core sampler. The sampler was

pushed into the soil and samples were collected at depths of interest. Also from each of these locations, surface soil samples (0-5cm) were collected at about 0, 50, 100, 150, 200 and 250m from the highway. The above depths and distances were chosen arbitrarily following the pattern of past studies (Al-Chalabi and Hawker, 2000; Ward et al, 1975 and Donisa et al, 2000). At each sampling point, samples were collected randomly from 10 points within about five meter radius and then properly mixed to get a good representation of the sampling point. From each of these ten points, a tablespoonful of soil sample was taken. The soil samples were then oven-dried at 65°C for about 48 hours.

(b) Vegetation Samples: The vegetation samples collected consist of foliage of low-growing shrubs and plants of between 0 to 2m tall. The foliage were taken from a variety of plants/shrubs including *Mangifera indica*, *Anacardium occidentale*, *Psidium guajava*, *Lycopersicon esculentum*, *Masanya smithii*, *Carica papaya*, *Ricinis communis*, *Gosypium spp.* The samples were also collected from the same distances as the soil samples. After the field vegetation sample collection, the samples were taken to the laboratory where they were subsequently dried in a forced draught oven at 100°C for between 24 - 48 hours. Care was taken to avoid shake-offs of surface deposits. The collection and preparation of samples for the rainy season followed the same pattern as that in the dry season study.

(c) Background Sample Collection: An interior village called Ungwan Mijinyawa, which is about 5km from the highway, was used for the background measurement. Five replicates of soil samples were collected in the same way as those from the study area.

Sample Preparation.

The soil samples were divided into four portions; each portion was then crushed and properly mixed. Then from each of these four portions, little quantity was collected and mixed again and further crushed into very fine powder. This was done for the purpose of homogenization in a process known as quartering. Thereafter, an average of 0.5g of each sample was measured and pelletized at 10 tons with the hydraulic press (SPECAC P/N 15.011) after being properly mixed with some drops of liquid binder (PVC dissolved in toluene). The pellets were finally weighed and then taken for analysis.

The vegetation samples were in like manner mixed and crushed into near-uniform fine particle sizes and pelletized for analysis. The pellets were then taken for qualitative and quantitative analysis and the results obtained are as shown below.

Results and Discussion

Background Lead Concentration

The mean background lead concentration, measured from five replicates was 31.4 ± 5.2 ppm. All other concentrations in excess of the above mean background value was considered as an indication of anthropogenic release into the environment. Lindsay, (1979) reported background lead concentration of the range of 2 to 200ppm in the United States with an average of 10ppm for uncontaminated soils. The mean concentration obtained in this work falls within the range of values in Lindsay's results but above his average of 10ppm. Al-Chalabi and Hawker, (2000) also reported an average background lead of 4 ± 0.1 ppm in Brisbane, Australia; while Ward *et al*, (1975) reported a mean background soil lead of 42 ppm in New Zealand. All other results were obtained after taking care of the mean background concentration.

Lead Profile with Depth

The results represented graphically in figures 2 to 4 show the concentration of lead with depth, taken by the roadside and at 100m away from the highway. The results of the profile taken from the roadside follow a general trend of a decrease in concentration with increasing depth. This is in agreement with the results obtained by Al-Chalabi and Hawker; Donisa *et al* and Ward and his collaborators despite the fact that different depths of investigation and soil types were used. For instance, this study made use of 80cm depth while Al-Chalabi and Hawker, and Ward *et al* made use 50cm and 10cm respectively. Also, the brown and sandy/loam soils were used in the experiment being reported here while Donisa *et al* used Cambic andosol, Andic acid brown and Andic mesobasic brown soils.

Evidence of deeper penetration of lead of automotive origin has been found under specific conditions. Vendenabeele and Wood, (1972) showed that the combined effect of low temperature and presence of Sodium Chloride diminished the ability of an alluvial soil to retain lead in the topmost layer.

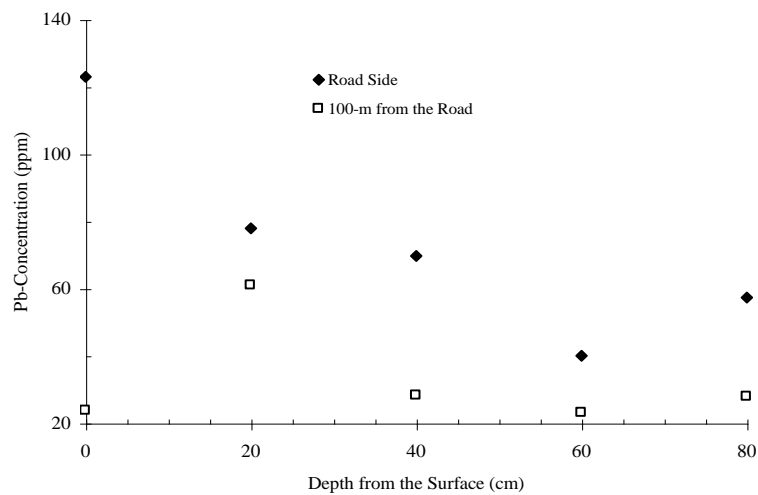


Figure 2: Depth Profile of Lead Concentration Measured at Giwa

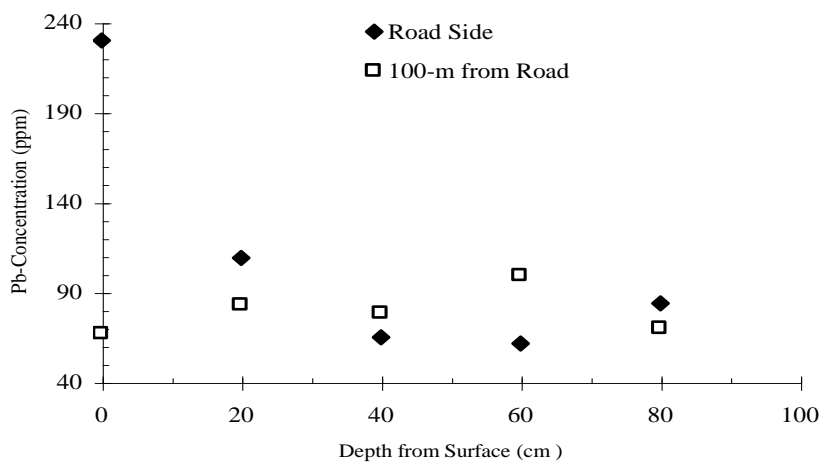


Figure 3: Depth Profile of Lead Concentration Measured at Shika

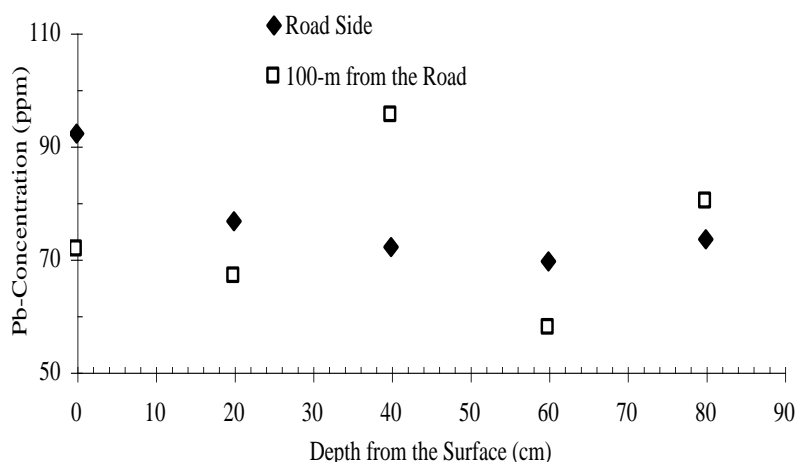


Figure 4: Depth Profile of Lead Concentration Measured at Samaru

It could be seen from the graph (fig.2) that the depth profile at the roadside showed a rise in concentration after about 55cm depth, implying that either activities in the past or effect of low temperature must have created a localized zone of elevated lead level at that depth. Apart from the profile taken from Giwa which showed a sharp decrease in lead concentration with depth, other locations showed gentle decrease in lead concentration with depth. The profile of Samaru, even though decreasing tends to do so in a much more gentle manner than those of Giwa and Shika; and this could be attributed to residential activities. In addition to the emissions from vehicles that ply the highway, town service vehicles also contribute to the lead levels measured at higher distances from the road as compared to those of Giwa and Shika. The results of the depth profile at the roadside also showed that the surface concentration (each of which is the highest for each profile) are between 3 to 7 times higher than the mean background soil lead concentration which is an indication that the excess lead is a result of aerial deposition. This observation appears mainly to be restricted to the aerial parts and surface soil. Hence, only surface soil was sampled for subsequent investigations. The depth profile at 100m away from the zero point showed initial increase in lead concentration and thereafter, a gradual decrease with in increasing depth. The reason for this trend is not immediately known. It is therefore subject to further investigation.

Variation of Lead Concentration with Distance from the Road.

Table 1 shows the range of lead concentration as a function of distance on both left and right sides of the road at the sampling locations while figures 5 – 9 show the variation of lead concentration with distance from the road.

The results of the investigation revealed that at the four perpendicular transects, lead concentrations generally decreased with increasing distance from the road

Table 1: Concentration of soil lead from the various sampling sites.

Sampling site	Mean lead concentration (ppm)	
	Left side of the road	Right side of the road
Giwa	93.4±27.6 (65.5-150.8)	96.2±13.1 (81.8-119.8)
Shika	80.1±19.4 (60.2-116.0)	84.2±14.0 (68.0-106.2)
Samaru	57.7±19.5 (45.5-101.0)	57.0±18.3 (35.4-94.3)
Kwangila	60.9±9.0 (51.7-77.1)	50.4±20.4 (37.4-95.4)

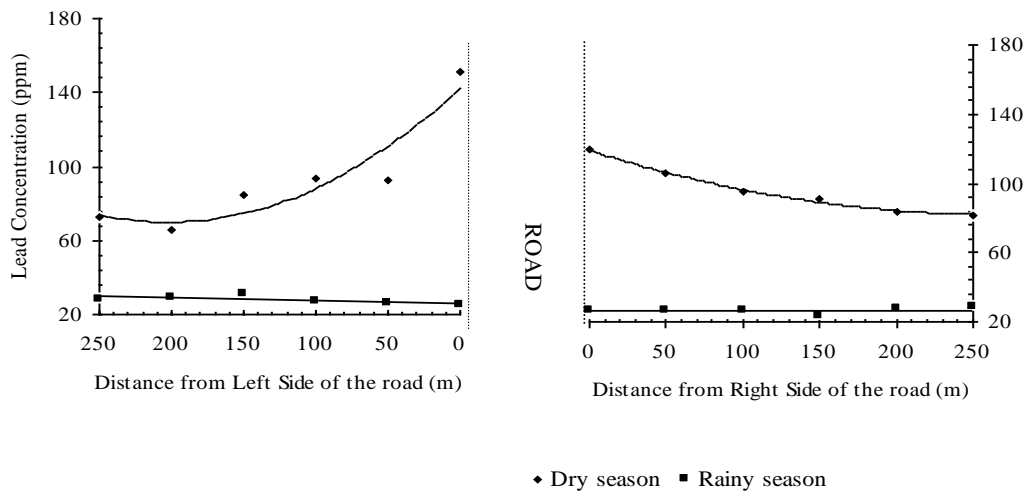


Figure 5: Variation of Lead Concentration with Distance from the Highway at Giwa

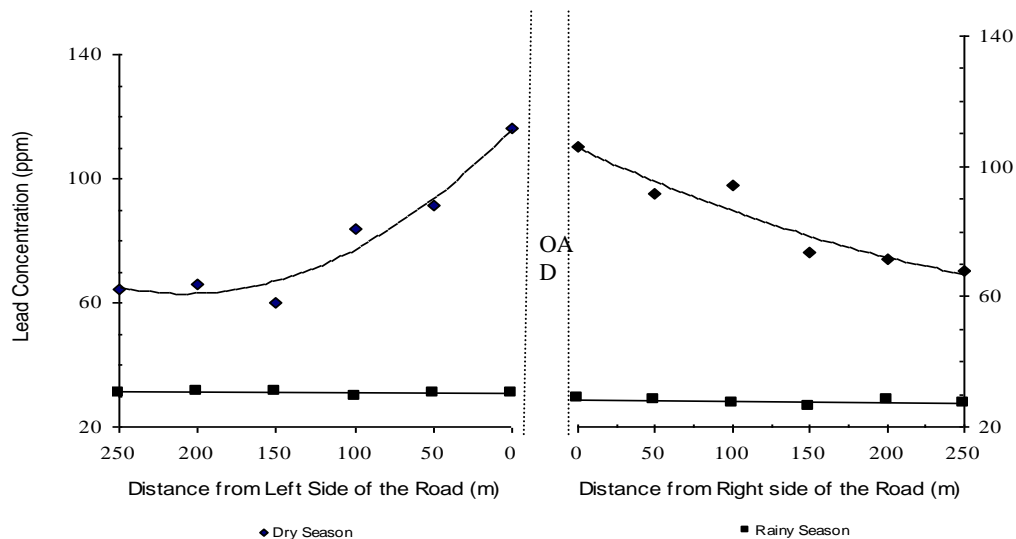


Figure 6: Variation of Lead Concentration with Distance from the Highway at Shika

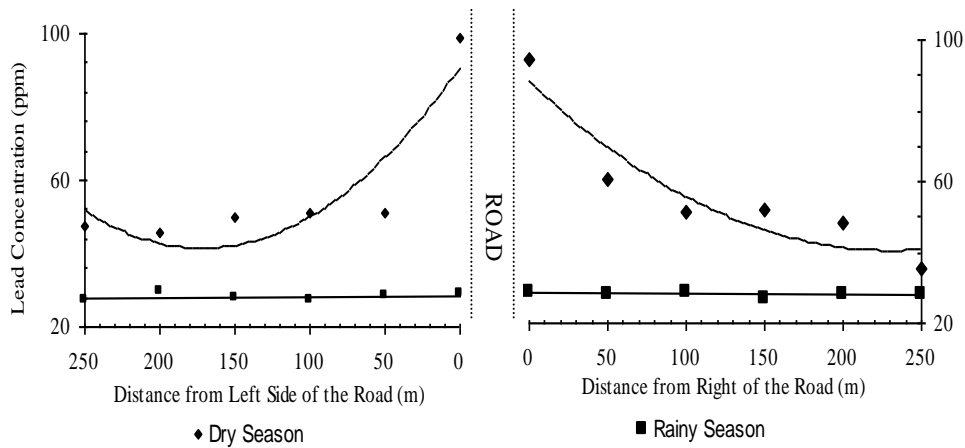


Figure 7: Variation of Lead Concentration with Distance from the Highway at Samaru

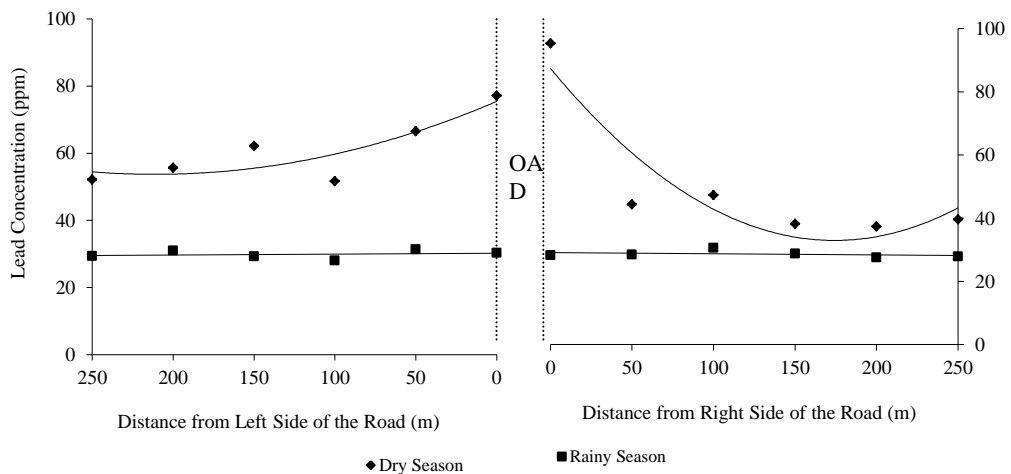


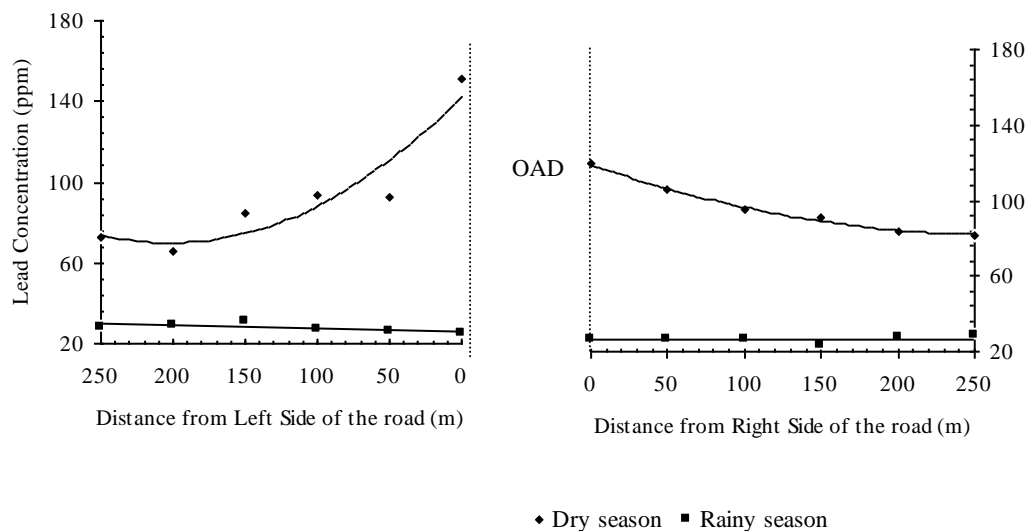
Figure 8: Variation of Lead Concentration with Distance from the Highway at Kwangila

Based on the pattern observed in the lead profile with depth at 100m from the road, this result would suggest that vehicular lead emissions are the major attributes since there were no other major sources of lead in the study area. However, while the trend is a gentle decrease with distance from the road for each of Giwa and Shika transects, the soil lead concentration at Samaru shows a sharp decrease with increasing distance from the road on the left with a rise after about 200m on the left. The emissions from vehicles plying the service road leading from the Gymnasium round-about of Ahmadu Bello University main campus, Samaru Zaria to NAERLS, IAR and Faculty of Agriculture on daily basis was highly suspected to be responsible for this rise. The trend at Kwangila shows a gentle decrease on the left and a sharp decrease on the right. The terrain at this site is sloppy towards the left (Kaduna direction) and this can enhance movement of emitted particles farther away from the zero point than on the right. The general trend also shows that the distribution of lead is generally not even on both sides of the road. This may be due to the topography coupled with the complex meteorological conditions and secondary dispersal processes.

The results obtained from vegetation do not deviate from that of soil. There was also a general trend of decrease in lead concentration with increasing distance from the road, a result that is in agreement with those of Clift *et al*, (1983); Wylie and Bell, (1973); Al-Chalabi and Hawker, (2000); Kingston *et al*, (1988) and Ndiokwere, (1984) However, due to turbulence of wind after passage of heavy vehicles, suspended particulates are pushed farther away from the road, giving rise to localized hot spots on the vegetation at some distances from the road. The difference in adsorption and up-take by the different species of plants sampled, nature of soil and the depth of water table in areas under study could also contribute to the observed pattern. The result here partially disagrees with that obtained by Ward *et al*, (1975) in which the vegetation lead concentration decreases evenly on both sides of the road with increasing distance from the road; a result which can only be obtained in a still condition. This condition is quite difficult to obtain in the study area.

Seasonal Variation of Lead Concentrations.

The results of the comparative investigation of lead concentrations between the rainy and dry seasons are embedded in figures 5 – 8. It is clear from the results that the soil lead concentration reduced drastically to background levels after a substantial rainfall of about



877.4mm. This observation indicated that greater amount of the surface deposits existed as removable particulates. Surface run-offs must have washed away the excess lead.

Conclusion

From the foregoing, it has been established that the levels of lead observed along the Zaria – Sokoto highway is a result of vehicular emissions. Though the general trend in this work agrees with previous works, there were a few areas of differences which may be due to difference in sampling procedures like the depth of investigation and the sub fractions of the core depth, nature of the soil, sample preparation and the analytical technique used, daily traffic densities, weather, topography and other meteorological conditions.

Taken *en bloc*, the results of this work show that the pollution levels along Zaria-Sokoto highway as a result of automotive emissions has not risen to a dangerous level at the moment. However, it must be pointed out that there is no safe dose of lead. Studies have indicated that the effects of lead can now be detected at levels well below those previously considered to be

without hazards (0.2 – 0.4ppm by Waldbott, 1978). There is also the danger of build-up of small doses either through inhalation, absorption through skin or bioaccumulation. Build-up effects can lead to unpleasant genetic and somatic consequences, most of which are due to relatively low level concentration of toxins over a long period of time (Botkin and Keller, 1998).

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Task Allocation and Skilled Worker Scheduling with Genetic Algorithm to Minimize Total Tardiness

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Abstract

This paper addresses the problem of task allocation and worker scheduling which is an important topic for many industries and corporations. Efficient utilization of manpower has always been a key concern in any organization and is one of the most important means to achieve productivity gain which also reinforces the importance of the problem. In this paper, problem is modeled as a flexible job shop problem (FJSP) with the objective of minimizing total tardiness. The flexible job shop differs from the classical job shop in that each of the operations associated with a job can be processed on any of a set of alternative machines (workers). The FJSP problem is solved by applying a Genetic Algorithm (GA) combined with variable neighborhood search (VNS). The genetic algorithm uses crossover and mutation operators to adapt the chromosome structure and the characteristics of the problem. Moreover, VNS is being used to obtain better results during the elitist selection phase of GA. The results show that proposed GA is an efficient method to solve task allocation and knowledge workers scheduling.

Keywords: Task Allocation, Total Tardiness, Flexible Job Shop Problem, Genetic Algorithm, Scheduling, Variable Neighborhood Search.

Introduction

In the era of knowledge economy, “The most important contribution management needs to make in the 21st century is to increase the productivity of knowledge work and knowledge workers.” Rational division, scheduling, and cooperation of knowledge workers are one of the determinants of enterprises to keep their sustainable competitive advantage. Therefore, task allocation and workers scheduling is a problem that calls for immediate solution (Wang and Zhen, 2011).

The worker scheduling problem is, in general, very difficult to solve, even when it is tackled in a simplified version containing only a single criterion and a homogeneous skill. In fact, the problem has been known to be NP-complete (Bartholdi III, 1981). In order to solve the problem; it has been studied by many researchers, and many theoretical research results have been proposed. Their optimization algorithms mainly include heuristic dispatching rules, mathematical programming, simulation-based methods, and artificial intelligence (AI) based methods and so on.

Zribi, El Kamel and Borne (2006) focus on the flexible job shop scheduling problem and they propose different approaches on minimizing the total tardiness due to the importance of respecting the due dates in production process and in the whole supply chain. The first approach is based on the decomposition of the problem as an assignment problem and a sequencing problem. In the first approach (two phase), first phase is made by an assignment technique based on a heuristic approach and the definition of an intermediary criterion. In the second phase, they apply a genetic algorithm to deal with the sequencing problem. The second approach is rather an integrated one based on priority rules to generate initial solution and genetic algorithm with intelligent mutation to solve the problem. The former approach gives good results in compare to the integrated approach. However, intelligent mutation usage and the possibility to act together on the assignment and on the sequencing properties in the integrated approach gives better results.

Scrich, Armentano and Laguna (2004) propose two heuristic approaches for total tardiness problem that are based on tabu search: a hierarchical procedure and a multiple start procedure. Initial solutions are created using dispatching rules in both approaches and they search for better results in neighborhoods that are generated by the critical paths of the jobs in a disjunctive graph representation. In the hierarchical procedure, for a given routing, tabu search is applied to the scheduling sub-problem and, after a predetermined number of iterations; a new routing is generated by reassigning an operation to a different machine. The multiple start heuristic starts from the solutions obtained with the application of a penalized dispatching rule, where the priority values are modified using residence frequencies associated with a diversification strategy. Tabu search is applied to the scheduling sub-problem originating from every starting solution. Their computational results showed that the hierarchical heuristic performs better for instances with low tardiness values, while the multi-start heuristic is better for instances with larger tardiness values.

Zhu, Chen and Zhang (2009) present a modified genetic search algorithm for the non-regular Job-Shop scheduling problem with due date. The chromosome representation they present is based on the operation-based representation. In order to reduce the search space, a procedure for generating active schedules is constructed. For avoiding premature convergence in the conventional genetic algorithms (GA), the precedence operation crossover (POX) and approach of the generation alteration model are presented.

Wang and Liu (2010) apply ant colony algorithm to task allocation and knowledge workers scheduling in an exploratory way, constructs a mathematical model of task allocation and knowledge workers scheduling. They use ant colony optimization algorithm to reduce the

number of optimization iteration and computation time. They execute their algorithm on a problem of 3 projects, and each project has 4 tasks. A total of 6 knowledge workers are available to finish these tasks. They found the best solution (total time span = 38) on 5th iteration and have stated that ant colony algorithm is a scientific and efficient method to solve task allocation and knowledge workers scheduling.

Wang et al. (2011) use particle swarm optimization (PSO) and tries to show that PSO is a scientific and efficient method to solve this problem. They prefer PSO because algorithm has few parameters to adjust, is easy to implement and can obtain better results in a faster and cheaper way compared to other stochastic methods. Moreover, PSO constructs solutions by searching whole solution space, and gives consideration to both local construction and overall performance of solutions.

Kacem, Hammadi and Borne (2002) aim to find an optimal solution for FJSP problem with the objective of minimizing the overall completion time and balancing the total workload of the machines. They present two new approaches to solve jointly the assignment and job-shop scheduling problems (with total or partial flexibility). They use a chromosome representation that combines both routing and sequencing information, and develop an approach by localization to find promising initial assignments. Dispatching rules are then applied to sequence the operations. Once this initial population is found, they apply crossover and mutation operators to simultaneously modify assignments and sequences, producing better individuals as the generations go by.

Research done by Tay and Wibowo (2004) proposes a new chromosome representation and a design of related parameters to solve the FJSP with GA efficiently. The objective is to find a schedule with shortest makespan, where the makespan of a schedule is the time required for all jobs to be processed in the job shop according to the schedule. They compare four different chromosome representations, testing their performance on some 10×10 (10 jobs, 10 machines) problem instances. Their result shows that the more the chromosome representation is formed by concatenating meaningful partial strings, the more appropriate genetic operators can be developed, and better results can be obtained. They also report some remarks on the best rates of crossover operators and mutation operators to generate the offspring.

This paper is organized as follows. In Section 2, problem definition and formulation are given. Proposed genetic algorithm for task allocation and scheduling problem is presented in Section 3. We discuss the computational results of the study in Section 4. Finally, in Section 5, we give concluding remarks and future work.

Problem Description and Formulation

A. Description

The problem of task allocation and skillful workers scheduling is to assign tasks of projects to workers. The main considerations that need to be taken into account are assigning most skillful workers to every task, and arranging them in order to minimize the total tardiness it takes to finish all projects.

The assumptions of this problem are as follows:

1. Every project has one or more tasks that are sequentially executed. That is, any task of a project can be started only when project's previous task is completed.
2. The process time of each task accomplished by different worker is known.
3. Every worker is able to execute the task only when he/she finishes the previous task.
4. One task is accomplished by one worker.

5. Every worker can accomplish one or more tasks but is able to perform only one task at a time.
6. The process time of a task accomplished by different worker is known and fixed.
7. Tasks and workers are allowed to wait.
8. Every project has a due date and may have release dates.
9. A worker is said to be more skillful on a particular task if he/she can perform that task in shorter time.

B. Formulation

The optimization objective is to minimize the total tardiness of all projects. The objective function and the constraints of task allocation and skillful worker scheduling can be described as a mathematical model as follows:

Minimize,

$$z = \sum_{i=1}^n T_i \tag{1}$$

Such that:

$$T_i = \max(0, C_i - d_i) \tag{2}$$

$$o_{ij} = s_{ij} + \sum_{k=1}^m t_{ijk} a_{ijk} \tag{3}$$

$$\sum_{k=1}^m a_{ijk} = 1 \tag{4}$$

$$s_{ij} = \max\left(o_{i(j-1)}, \sum_{k=1}^m Q_{ij}(k, p - 1) a_{ijk}\right) \tag{5}$$

$$o_{i0} = r_i \tag{6}$$

$$Q_{ij}(k, p) = W_{ij}(k, p) + t_{ijk} \tag{7}$$

$$W_{ij}(k, p) = \max(Q_{ij}(k, p - 1), o_{i(j-1)}) \tag{8}$$

$$o_{ij}, s_{ij}, t_{ijk}, r_i, C_i, d_i, W_{ij}(k, p), Q_{ij}(k, p) \geq 0 \tag{9}$$

$$a_{ijk} \in \{0,1\} \tag{10}$$

- n projects are denoted as $P = \{P_1, \dots, P_i, \dots, P_n\}$, $i = 1, 2, \dots, n$
- m workers are presented as $E = \{E_1, \dots, E_i, \dots, E_m\}$, $i = 1, 2, \dots, m$
- Every project P_i has one or more tasks, $O_i = \{O_{i1}, \dots, O_{ij}\}$, $j = 1, 2, \dots, k$ where k denotes the number of tasks of P_i
- t_{ijk} denotes the process time that the worker E_k accomplish the task O_{ij}
- s_{ij} denotes the start time of the task O_{ij}
- o_{ij} denotes the finish time of the operation O_{ij}
- d_j denotes the due date of project P_i
- r_j denotes the release date of project P_i

- C_j denotes the completion time of project P_j
- For a task allocation plan, a_{ijk} denotes the task O_{ij} is or is not allocated to the p^{th} task of the worker E_k ,

$$a_{ijk} = \begin{cases} 1, & O_{ij} \text{ is allocated on worker } E_k \\ 0, & o.w. \end{cases}$$

- $W_{ij}(k,p)$ denotes the start time of the worker E_k to start the p^{th} task (O_{ij}).
- $Q_{ij}(k,p)$ denotes the finish time of the worker E_k to finish the p^{th} task (O_{ij}).

Proposed Genetic Algorithm

GA is a local search algorithm that follows the evolution paradigm. Starting from an initial population, the algorithm applies genetic operators in order to produce offspring (in the local search terminology, it corresponds to exploring the neighborhood), which are presumably more fit than their ancestors. At each generation (iteration), every new individual (chromosome) corresponds to a solution, i.e., a schedule of the given problem instance. The strength of GA with respect to other local search algorithms is due to the fact that in a GA framework more strategies can be adopted together to find individuals to add to the mating pool, both in the initial population phase and in the dynamic generation phase. On the other hand, VNS has the ability of local search throughout different neighborhood structure to avoid becoming trapped in a local optimal, and it is used to enhance the quality of individuals.

GA is used to perform global exploration among populations, while local search is used to perform exploitation around chromosomes. Because the local search can use much of the problem-specific knowledge to improve the solution quality, the hybrid approach often outperforms either method operating alone.

In the proposed algorithm a hybrid form of GA and VNS is used. The algorithm stops after a fixed number of iteration executed or after a predefined number of no improvements achieved. The algorithm steps and overall structure can be described as follows:

Algorithm:

Step1: Initialize population randomly with P individuals where P is population size and set it as current population.

Step2: Compute the fitness for every chromosome in current population, by which all individuals are evaluated. If the best solution of the current population is better than the best solution of the previous population then replace the best solution in the memory.

Step3: If the termination criterion is satisfied then go to Step 6, else go to Step 4.

Step4: Generate intermediate population with size P using offspring generation algorithm.

Step5: Apply modified elitist selection algorithm using VNS to construct the next population whose size is P and set it as current population then go to Step 2.

Step6: Output the schedule and objective value and STOP.

A. Initial population

The initial chromosomes are obtained by random permutation of tasks and workers. The population is generated randomly to allow the entire range of possible solutions (solution space). During random chromosome generation, task execution order for each project is preserved and machine assignments are done such that the resulting chromosome is a feasible schedule and each chromosome in the population represents a unique solution.

B. Genetic Coding

In order to implement the proposed GA, a feasible schedule is represented symbolically by a string. The genes of a chromosome describe the assignment of tasks to the workers, and the order in which they appear in the chromosome describes the processing sequence of tasks. Each chromosome represents a feasible solution (schedule) for the problem and the length of the chromosome is equal to the total number of the tasks in a problem. Each gene is formed by triples (i, j, k), where:

- i is the project that task belongs to,
- j is the progressive number of that task with in project i,
- k is the assigned index of the worker in the worker array of that task and k = 1 to maximum number of workers.

A worker array holds the workers that can accomplish the corresponding task. The workers are sorted in the array in ascending order according to their processing times.

Suppose, we have 4 workers (E1, E2, E3, and E4) and 3 projects (P1, P2, and P3). Projects have 3, 1 and 2 tasks respectively. According to their skillsets, workers can process those tasks with the processing times stated in Table 1. Starred cell denotes that worker cannot accomplish the task.

Table 2 Task Process Times

		E1	E2	E3	E4
P1	O1,1	1	4	5	8
	O1,2	7	*	6	5
P2	O2,1	2	*	5	*
P3	O3,1	12	5	4	7
	O3,2	5	6	3	5
	O3,3	2	4	*	*

The sorted worker array for each task is shown in Table 2. The worker index of a task is calculated from an assigned worker index with the following formula:

$$WIndex = \begin{cases} AWIndex, & AWIndex \% N == 0 \\ AWIndex \% N, & o.w \end{cases} \quad (11)$$

- N is the number of workers that can accomplish that task.
- WIndex is Worker Index of task
- AWIndex is Assigned Worker Index of task

If the assigned worker index of task O2,1 is 3, then the worker index is 1 and the worker for that task is E1. Similarly, if the assigned worker index of task O3,1 is 4, then the worker index of the task O3,1 is 4 and worker for that task is E2.

Table 3 Tasks' Sorted Worker Arrays

		Worker Index			
		1	2	3	4
P1	O1,1	E1	E2	E3	E4
	O1,2	E4	E3	E1	
P2	O2,1	E1	E3		
P3	O3,1	E3	E2	E4	E1
	O3,2	E3	E1	E4	E2
	O3,3	E1	E2		

A sample chromosome is represented by the following string:

(1,1,3)	(1,2,2)	(2,1,3)	(3,1,2)	(3,2,4)	(3,3,1)
---------	---------	---------	---------	---------	---------

The above chromosome representation is converted to the actual representation during objective value and the fitness value calculation. The actual representation (schedule) with the worker assignments can be found by replacing the worker index with the corresponding worker in Table 2 using the formula 11:

$$S = (O11,E3), (O12,E3), (O21,E1), (O31,E2), (O32,E2), (O33,E1)$$

C. Offspring Generation

The new generation is obtained by changing the assignment of the tasks to the workers (one-point crossover, two-point crossover, swap mutation, shift mutation). A reordering algorithm is applied to preserve feasibility of new individuals. New individuals are generated until a fixed maximum number of individuals (population size) are reached. The algorithm is explained in Figure 1.

Offspring Generation (P = current population):

- Define set of parent chromosome $S, S = \emptyset$
- Define set of offspring chromosome $N, N = \emptyset$
- Let C , represents a chromosome
- **while** $sizeof(S)$ not equal to 2 **do**
 - $C \leftarrow roulette_wheel_selection(P)$
 - **if** S does not contain C
 - $insert, S \leftarrow C$
- $rnd \leftarrow$ a random number between (0,1]
- **if** $rnd \leq P_{crossover}$ **then**
 - $N \leftarrow Crossover(S[1], S[2])$
- **else**
 - $N \leftarrow Mutate(S[1], S[2])$
- **while** $i = 1$ to 2 **do**
 - $C \leftarrow N[i]$
 - $N[i] \leftarrow reorder(C)$
- **return** N

Figure 1 Offspring Generation Algorithm

Crossover Operation: Crossover operation produces two offspring, start from a couple of parents by replacement and recombination of the partial structure of them. It is key operation and determines the global searching capability of GA. The most important criterion of crossover operation is feature inheritance and feasibility of chromosomes in FJSP. The feature inheritance is the way to preserve good characteristics of adjacent jobs of parents to offspring.

During the past decades, several crossover operators have been proposed for permutation representation, such as partial-mapped crossover, order crossover, cycle crossover, and so on (Bulkan, 1999). In this study, one-point crossover and two-point crossover operators are applied to the chromosomes. The crossover operator, that will be applied, is chosen randomly from the two operators.

Parent chromosomes are chosen within the population by roulette wheel selection algorithm. After applying crossover operator, the child chromosome (or new schedule) may become infeasible. Therefore, a reordering algorithm is applied to the child chromosome to make it feasible. The reordering algorithm assigns the progressive task number to the genes of the same project in their execution order (from left to right). Since worker is represented as index and actual worker is calculated by formula 11, the reordering will not end with an infeasible solution.

Suppose the following offspring is generated after applying two-point crossover:

(1,2,3)	(2,1,2)	(1,1,3)	(3,3,1)	(3,2,4)	(3,1,2)
---------	---------	---------	---------	---------	---------

It can be seen that the offspring is infeasible since 2nd task of first project (O1,2) is being processed before the 1st task of the same project, similarly 3rd and 2nd tasks of the third project is being executed before the 1st task of the project. By applying the reordering algorithm, a feasible offspring is obtained:

(1,1,3)	(2,1,2)	(1,2,3)	(3,1,1)	(3,2,4)	(3,3,2)
---------	---------	---------	---------	---------	---------

The pseudo-code of the algorithm is given in Figure 2:

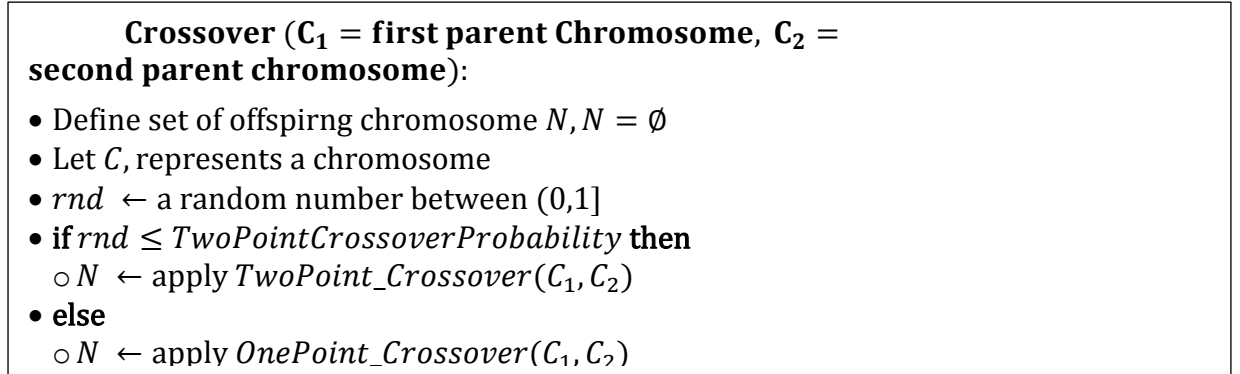


Figure 2 Crossover Algorithm

Mutation Operation: Mutation operation can maintain the diversity of population in classical genetic algorithm, and it produces by slight disturbance to chromosomes. There are many mutation operators for different types of problems such as swap, insertion, scramble and inversion mutation (Bulkan, 1999; Deep and Mebrahtu, 2011).

Proposed algorithm applies swap mutation and scramble mutation operators together sequentially to the selected chromosome in the specified order. The mutation operators are applied to the selected parent chromosomes if a crossover operator has not been applied to them. That is:

$$P_{mutation} = 1 - P_{crossover}$$

where,

- $P_{mutation}$ = Probability of mutation operators being applied to the chromosome.
- $P_{crossover}$ = Probability of crossover operator being applied to the chromosome.

D. Fitness Function and Selection Method

The fitness evaluation function for the chromosomes coincides with the total tardiness value of the solution they represent. Therefore, since we are searching for solutions with lower values of the total tardiness, the genetic evolution will prefer chromosomes with a lower fitness value. For each generation, all the chromosomes are evaluated, and the best individual is recorded. By fitness value, selection operation can select superior individual and elimination of inferior from the population. Roulette wheel selection is used as selection method. In roulette wheel selection, a random number $rand$ $[0, 1]$ is generated. If $rand$ is subject to formula 12:

$$\sum_{j=1}^{i-1} f_j / \sum_{j=1}^{popsize} f_j < rand \leq \sum_{j=1}^i f_j / \sum_{j=1}^{popsize} f_j \quad (12)$$

Then state i (i^{th} chromosome) is selected to reproduce, where f_i is fitness degree value of chromosome i .

E. Modified Elitist Selection

Retaining the best individuals in a generation unchanged in the next generation, is called elitism or elitist selection.

Proposed Algorithm uses elitist selection to create next generation by selecting best individuals from previous population and intermediate population with predefined percentage. Moreover, algorithm also introduces a fix percentage of random chromosomes to the next population to preserve the diversity of the solution space.

The VNS algorithm is applied to the best chromosomes chosen from intermediate population with corresponding probability. If VNS output is better than the chosen solution (from intermediate population) then better one is used in next population.

25% of the next population is provided by the best chromosomes from the previous population, ~65% of the next population is provided by the best solutions from intermediate population (some of which are the results of the VNS algorithm) and the rest (~10%) is provided by random chromosome generation. Since duplicated solutions are not allowed in a population the intermediate population may be slightly less than 65% and the random chromosome percentage may be slightly higher than 10%.

Table 4 Next Population Content Percentages

Percentage (%)	Source
25	Bests from previous population
~65	Bests from intermediate population + VNS algorithm results
~10	Random chromosomes

F. Variable Neighbourhood Search (VNS)

Variable neighbourhood search (VNS), a metaheuristic proposed recently by Mladenović and Hansen (1997), is based on a simple principle: systematic change of neighbourhood within a possibly randomized local search. In this study, VNS works as a kind of local search method under the framework of the proposed Genetic Algorithm.

As stated earlier, VNS algorithm is applied to the best chromosomes chosen from the intermediate population with a corresponding probability. VNS algorithm takes the chromosome and iteration size (stopping condition) as input parameters and outputs a better solution if it finds.

Neighborhood structures describe the methodology of moving from one solution to another neighborhood solution in the solution space. The neighborhood structures must work so that they generate feasible solutions. Proposed algorithm uses three different neighborhood structures. First one and second structures are mutation operators that are used in GA framework (swap and scramble mutations respectively). Last structure (called “swapMachines”) selects two random genes from a chromosome and changes their worker indices. That is, if (3,2,5) and (1,4,2) genes are selected randomly, they become (3,2,2) and (1,4,5) in the neighbor chromosome. Since the interchanged parts are worker indices and actual

workers are calculated using Formula 11, neighborhood chromosome cannot represent an infeasible solution. The VNS algorithm is given in Figure 3:

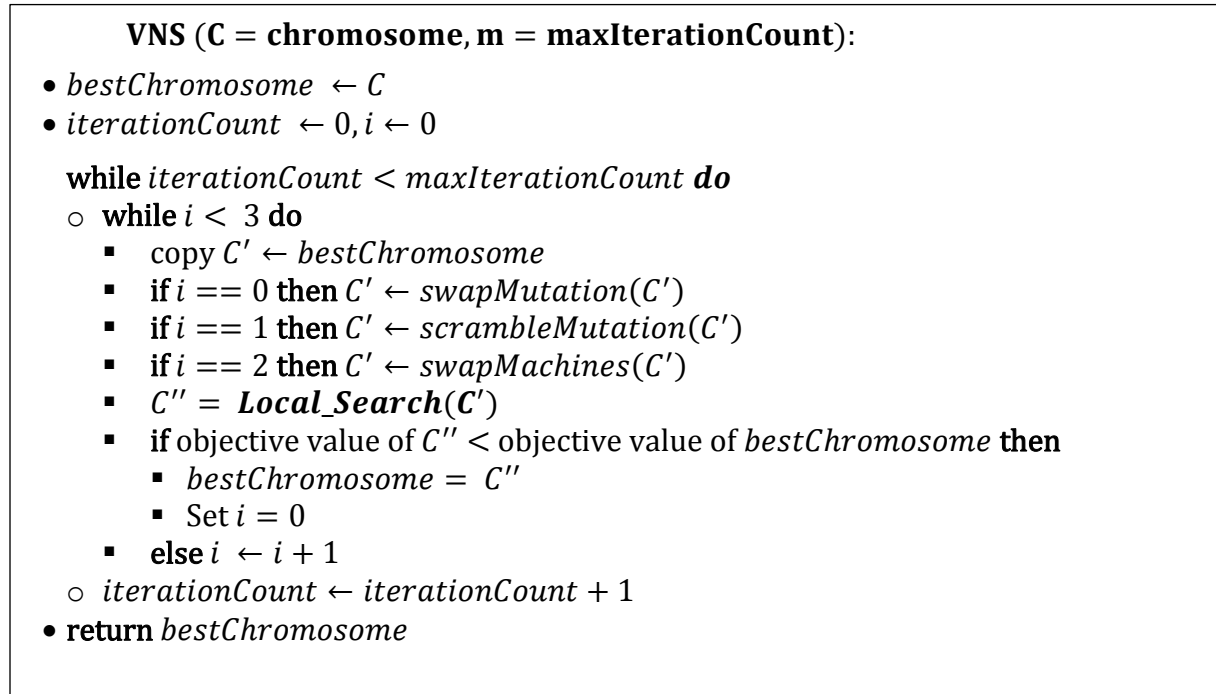


Figure 3 VNS Algorithm

As seen in Figure 3, when a neighborhood chromosome is determined by one of the neighborhood structures, a local search algorithm further processes it to find a better solution. The local search algorithm uses a modified version of insertion mutation explained in research of Deep and Mebrahtu (2011) such that, it selects an operation randomly from each job, and applies insertion mutation to the gene represents that selected operations. In other words, local search executes insertion mutation “project size of the problem” times and outputs the best solution.

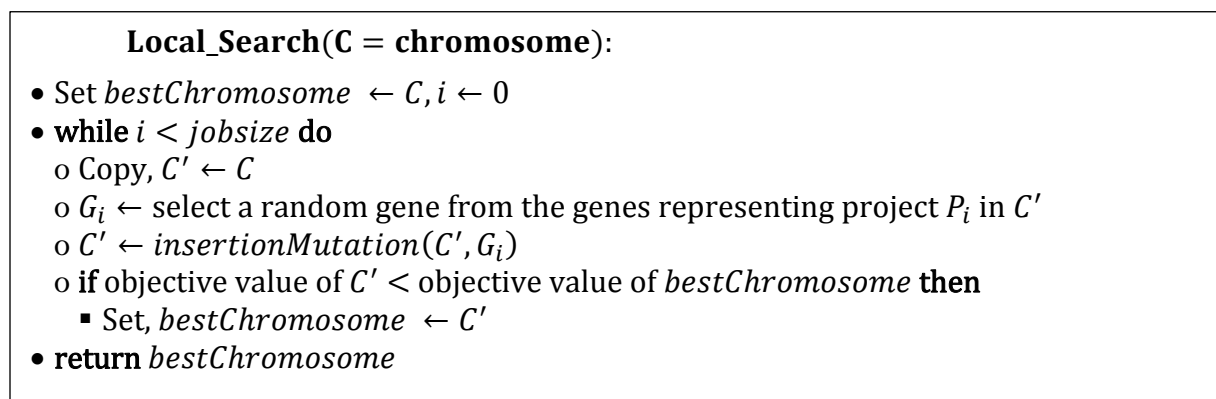


Figure 4 Local Search Algorithm

Computational Results

The algorithm is implemented in Java and tested on windows 7 based computer having Intel i5 processor and 4GByte memory.

In literature, there are almost no data sets related to task allocation problem or FJSP for minimizing total tardiness. Most of them modify the datasets prepared for minimizing makespan but does not mention about how the modification is done or give the data set. Therefore, we compare our results with the results obtained by other authors where possible and modify the existing datasets that are prepared for minimizing makespan. The evaluated problem instances are as follows:

- Two problems from Zribi et al. (2006).
- Problem stated in Zhu et al. (2009).
- Two problems from Zhang et al. (2005).

Since Problems stated in Zribi et al. are FJSP problems to minimize total tardiness, they are applicable to our problem as is. However, problem stated in Zhu et al. (2009) is for Job shop scheduling problem and two problems used in Zang et al. (2005) are for minimizing makespan. Therefore, latter problems are modified to suit our case. The due dates for the problem stated in second set are known and due dates for the problems stated in first and third set are calculated according to the formula stated in Zribi et. al. (2006) and also shown below. The release dates of the projects in the problems are equal to 0.

$$d_i = r_i + \beta \sum_{j=1}^{n_i} \overline{p}_{ij} \quad (13)$$

$$\beta = \frac{N * M}{100} + 1 \quad (14)$$

where,

- \overline{p}_{ij} is the mean of processing times of task O_{ij}
- n_i is the number of tasks of project i
- N is the number of projects
- M is the number of workers

The release dates of projects can be chosen between 1 and $\sum \overline{p}_{ij}$. The due date of each project depends on the value of β and on the value of \overline{p}_{ij} and it can be computed using the first formula shown above. The parameter β is generated according to second formula above allowing to generate tight due dates.

For the proposed genetic algorithm, tests have been done with the following parameter values:

- Population Size = 200
- Number of Iteration = 50 (Stopping Condition)
- Number of No Improvement = 100 (Stopping Condition)
- Crossover Probability = 0.8%
- Two-point Crossover Probability = 0.7%
- VNS Execution Probability = 0.3%
- VNS Iteration Count = 5

Due and release dates of the problems that are used in tests shown below:

Zribi1: $r_1=0, d_1=14, r_2=0, D_2=10, r_3=0, d_3=13$

Zribi2: $r_1=0, d_1=38, r_2=0, d_2=30, r_3=0, d_3=35, r_4=0, d_4=38, r_5=0, d_5=37, r_6=0, d_6=40, r_7=0, d_7=33, r_8=0, d_8=36, r_9=0, d_9=38, r_{10}=0, d_{10}=36$

Zhu1: $r_1=0, d_1=39, r_2=0, d_2=64, r_3=0, d_3=57, r_4=0, d_4=52, r_5=0, d_5=45, r_6=0, d_6=49$

Zhang1: $r_1=0, d_1=30, r_2=0, d_2=37, r_3=0, d_3=27, r_4=0, d_4=32, r_5=0, d_5=36, r_6=0, d_6=36, r_7=0, d_7=33, r_8=0, d_8=39, r_9=0, d_9=31, r_{10}=0, d_{10}=36$

Zhang2: $r_1=0, d_1=29, r_2=0, d_2=43, r_3=0, d_3=31, r_4=0, d_4=32, r_5=0, d_5=44, r_6=0, d_6=37, r_7=0, d_7=35, r_8=0, d_8=42$

Each problem has been tested for 20 times with the stated parameters and the results are shown below:

Table 5 Results - Total Tardiness

	Size	Zribi GA	Zhu GA	Proposed GA		
		Best	Best	Best	Worst	Avg.
Zribi1	3x3	-	-	0	0	0
Zribi2	6x10	20	-	0	0	0
Zhu1	6x6	-	6	6	7	6.2
Zhang1	10x10	-	-	0	0	0
Zhang2	8x8	-	-	0	0	0

Zribi et al. (2006) use the first problem (Zribi1) as an illustrative example therefore they did not state the result of the problem. Except for the problem set Zhu1, proposed algorithm finds the objective value as 0. As mentioned by Zhu et. al. (2009), the optimal value of the problem Zhu1 is 6 and same value is found by the proposed algorithm. The results and the schedule of the solution of the Zribi2 problem found by proposed algorithm is shown in Table 5 and in Figure 5 (as Gantt chart) respectively.

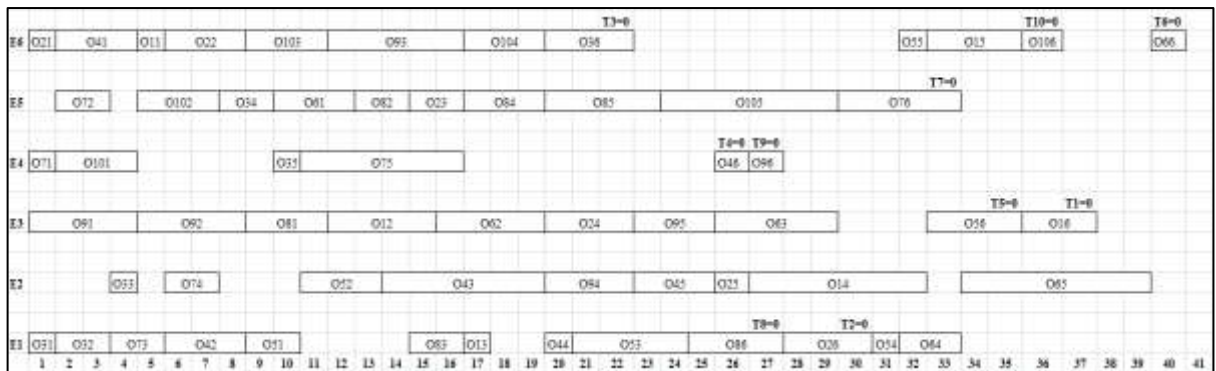


Figure 5 Schedule of the Solution of Zribi1

Table 6 Completion Times

Project No	Completion Time	Due Date	Tardiness
P1	37	38	0
P2	30	30	0

P3	22	35	0
P4	26	38	0
P5	35	37	0
P6	40	40	0
P7	33	33	0
P8	27	36	0
P9	27	38	0
P10	36	36	0

Conclusion

In this paper, an efficient algorithm is proposed for task allocation and skilled worker scheduling problem.

This method enables us to construct solutions with good quality in a reasonable computation time. By using some numerical example of related works, we demonstrate the efficiency of proposed algorithm. The results are better than or same as the other related approaches.

Introducing VNS to the elitist selection phase of the GA, the algorithm becomes more explorative around good solutions that results in finding better solutions.

The study of the other considerations (such as fair task distribution among workers or minimizing total processing time) in the multi objective optimization seems an interesting subject that can enrich the proposed approach and give scientific benefits.

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