

Dealing with Unethical Colleague in the field of Biomedical Engineering

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Abstract— Biomedical Engineering is a huge field taking the professions of doctors, engineers, nurses, administrative staff, physicists, chemists, biologists, etc. on the same platform. In this huge area, a biomedical engineer needs to work with so many people having different mentalities. As a biomedical engineer, one has to follow the ethics of engineering; not administrative or doctors but these two ethics can be added according to his duties and responsibilities. In the workplace, one may face that his coworker is skipping his duties, puts his computer on even at the time of leaving, fraud ling money, disclosing confidential information, using the company's property for his personal need, or any other unethical activities. In that case, what should a biomedical engineer do? Should he report to the manager or should he restrain himself from involving in another person's matter? In this study, the authors have tried to provide an ethical solution to the unethical behaviors of coworkers.

Keywords— Biomedical engineering; ethics; canon; public safety; obstructive sleep apnea

I. INTRODUCTION

Biomedical Engineering is the research, development, and application of medical technology for the benefit of healthcare. It's the convergence of engineering applications of principles to human biology or healthcare [1]. Biomedical engineering is a vast subject taking physics, chemistry, biology, engineering, statistics, and computer science on the same platform. A biomedical engineer has to follow the ethics of engineering as well as a doctor. Also, sometimes, if he plays the role of administrative staff, he has to follow the ethics of that too.

Engineering work generally involves public safety, public health, and the environment. The word 'Ethics' was derived from the ancient Greek word 'ēthikós' which means "relating to one's character". The Greek word 'ēthikós' came from the root word 'ēthos' which means moral, character, or nature [2]. The word ethics is commonly used as a synonym of 'morality' which means the moral principles of a particular tradition, individual, or any group [3]. Historically, Socrates, Aristotle, and Plato were the teacher of ethics. "Nicomachean ethics" was the first book on ethics written by Aristotle where he mentioned humans as social animals who need social communications. He also declared ethics as the most important part of social communications [4].

J. Belitz [5] has tried to clarify the issues related to unethical and unprofessional behaviors of misbehaving colleagues. He has also recommended some prevention techniques to maintain a good ethical environment in workplaces. A great number of clinicians feel uncomfortable reporting against unethical coworkers and thus they do not intervene with them. Clinician falls in a dilemma when they find that their colleagues are

involved with unethical activities; think about their colleague's privacy and confidentiality and on the other hand, think about patient safety. Some people think about the difficulties that may face their colleague if his complaint against him make some problems like family problem, marital problem, financial problem, social problem, etc. it is concluded that if any job holder respects his social obligations over the individual right, then he must intend to report against his unethical colleagues.

In ref [6], the ethical principles of the psychologists approved by the "American Psychological Association (APA)" have been mentioned. The ethical conduct addressed in this paper is related to the field of psychology, not to any other field. It is stated that if any ethical principles of the psychologists go against the government rule and laws then the psychologists must try to remove the conflicts and if it is unresolvable, the government law has to be maintained. According to the APA's code of ethical principles, if any psychologist observes that his colleagues are violating the ethical principles, he should discuss it with his colleagues privately and bring that matter to his attention. If the problem is critical and may harm any person or organization and it is useless to discuss formally or informal ways with the guilty psychologist, then he can take suggestions from the supervisor or the national committee on professional ethics if necessary. Taking suggestions from the state committee is not suggested if it violates confidentiality.

Boyd et al. [7] have explained whether a colleague should refer his colleague who has substance use disorder to the Physician Help Program (PHP) or not. In the case of a physician, it is challenging to decide it because if the colleague is impaired and do not become reported, he can make harm to the patient come to him and even the patient may die because of it; on the other hand, if the colleagues are not impaired then he will lose his temper, inattentive to his duty. According to ref [7], it is also necessary to think twice before intervening in the suspicious colleague's performance as it can harm the physician's life. When the signs are overt like erratic behavior, poor clinical decision making, slurring words that clarify that the colleague is impaired, it is imperative to take immediate action. For a clear substance-taking problem, a physician should be referred to the PHP and after the treatment, he is faced with a random alcoholic test to ensure that he is not continuing anymore.

Brodsky et al. [8] reported that many psychologists found that their colleagues have a huge lacking of knowledge, performance, and ethics in their works. According to the code of ethics of the "American Psychological Association", one must have to confront that colleague before reporting against him. This confronting is generally avoided because people feel discomfort while talking to colleagues about it as because of it that colleague may feel insulted. Even education and training are

not good enough to remove this mindedness. In this article, the authors have tried to resolve this problem. According to this article, independent psychologists are unknown to each other and often asked to comment on another psychologist’s work critically and carefully.

Levenson reported [9] that it is an ethical obligation for a jobholder to intervene appropriately if he observes that one of his colleagues is doing unethical practices. For example, it is unethical behavior if a professional does a sexual relationship with his client. In that case, ethical intervention is necessary though both the client and the colleague will interfere with it. Ethical codes can be violated in many ways like ignoring the duty, conflict of interest, questionable financial works, sexual relations with the client. In this article, the author has mentioned a woman who is involved in sexual intercourse with her therapist. The author has cited the possible actions that can be taken against the unethical colleague. If any physiologist hears any misconduct about his colleague from another colleague, he should first know it clearly, contact him (suspected colleague) directly, and then report to the appropriate authority.

II. THE DIMENSION OF ETHICAL WORK CONTEXT

Ethical context is the summation of principles, social norms, and activities that support ethical behavior in the workplace and ethical decision-making [10]. This ethical context consists of individual ethics and managerial ethics. It becomes strong when it is used for making any policy [11]. Pastoriza et al. have categorized the ethical work context into two sections.

1. Social Support Context: It comprises six managerial practices that are used to encourage the employees for assistance to other workers and do the task relying on the commitments to the organization.

- The managers give importance to providing help and guidance to employees.
- Managers ensure equity and impartiality in decision-making.
- Managers have to improve the individuals so that the collective decision does not affect them.
- Transparency has to ensure access to resources.
- Freedom is ensured for lower-ranked levels.
- Fair-mindedness in staffing policies.

2. Accountability Context: This contains six managerial practices used to encourage employees to be obedient to their promises and to endeavor for collective goals. It is part of the ethical context to make sense to the employees that they must live by their promise and work their best for the shared goals.

- Creating a clear standard of performance and behavior.
- Give feedback to employees frequently.
- Sanctioning with credibility and reliability.
- Defining a communal identity for the organization.
- Defining a common amination for the organization
- Providing a personal sense in a way that individuals contribute to the organization’s overall purpose.

Canons for Ethics in Biomedical Engineering: Ethics in the field of biomedical engineering must contain the general

standards for respecting human dignity and protect himself in the event of clinical applications and biomedical research and development. Three values must be addressed-

- Human dignity and integrity.
- Freedom in the workplace and responsibility.
- Social justice and solidarity [12]

According to the “National Society of Professional Engineers” of the United States, engineering has a very direct and important impact on the quality of life of all people of society [13].

Every ethics has some fundamental canons. According to “NSPE Code of Ethics of Engineers”, the fundamental canons are:

Table I: Fundamental Canons according to “NSPE Code of Ethics”

Canon No.	Canon Theme
1	Hold the paramount health, safety, and welfare of the public.
2	Provide their services only in their area of competence.
3	Issue public statements in an objective and truthful manner.
4	Act as a faithful agent or trustee for each client or employer.
5	Always avoid deceptive acts.
6	Their behavior should such that it increases their honor, reputation, and usefulness of the profession.

Public Safety, health, and welfare: Engineers play a crucial role in public health, safety, and welfare. It is believed that public safety, lives, and health depends on the engineering decision, judgment and in the case of biomedical engineering, the patients are sometimes directly dependent on the engineer’s decisions. So, engineers are obliged to report for any bad situations or consequences if he assumes. Also, if any other person, colleague wants to ignore public health or safety, he must report to the managerial body. Engineers should always look for any way for the welfare of the general public, the advancement of the community’s health, wealth, and safety [14].

Areas of performance: An engineer should perform their works only in their area of specialization or competence. A biomedical engineer should not even be involved with clinical engineering work though clinical engineering is a sub-branch of biomedical engineering without the emergency and permission from the authority. The task of engineering should only be taken after having academic education, training, or experience.

Public statement: An engineer should know public thinking and he should prevent any misunderstanding among the public about the achievement of engineers. Engineers should be

objective and truthful to the statement and reports and they should include all the relevant information in the reports, statements, and testimony. An engineer should not make any comment, issue any statement, or do any criticism inspired or paid from any interested party unless they disclose themselves openly to the public and it becomes justified.

Working as a Faithful agent: Engineers should work as faithful agents to their clients. They should not be involved in any work that creates a conflict of interest. Engineers should not take any compensation or benefit from any party unless the circumstances are fully disclosed and agreed upon by all parties. They should make any issue clear to the clients if they assume that this issue may create any judgmental questions.

Building Profession based on Merit and Reputation: Engineers should build their profession based on their merits and should not compete with others unfairly. Negotiation of contracts is allowed fairly and should demonstrate competence and qualifications. The service and benefit from the service of the engineers should be fair and reasonable. It is also unethical to falsify any academic qualifications and experience before the assignment of the task. All the article, engineers write has to be constructive and will increase dignity.

Honor, Integrity, and Dignity of the Profession: Engineers should work their best to enhance their honor, dignity, and integrity. They should not allow using their names to any company, organization, or firm which they know is doing money fraudulent or unethical/unlawful activities. They should avoid any kind of engineering or non-engineering organizational involvement which are doing any unethical activities.

Professional development throughout the career: Engineers should try to do their professional development throughout their careers and also, they should help other engineers who are under their supervision. Engineers must encourage their employees to further studies and they should publish professional articles for the betterment of the juniors. Engineers should participate in international conferences and seminars to share their experiences with other fellows so that the whole community can be benefited from their experiences.

III. ISSUES WITH COLLEAGUES IN BIOMEDICAL ENGINEERING

In the job field, one has to pass a min of 8 hours a day with a colleague. It is found that coworkers can be good/best friends if they work nearby, share a common ground, and involve themselves in extra-organizational socializing [15]. A friendly environment in the job field and friendship relations among coworkers can play an important role in personal professional development and organizational improvement. According to ref [16], "Friendships at work are part of institutional participation and personal career-building, serving important purposes for both organizations and individuals". If the colleagues are friendly, the work becomes more enjoyable [16], and also the organization can follow the ethics easily as it is proved that if the coworkers are friendly then the employees become more lawful to the company's rules and regulations [17].

In a job field a biomedical engineer may face some problems with his coworkers:

Language problem: It is one of the most important problems that biomedical engineers face in the workplace. Biomedical engineering is a matter of global technology. In the present era, the whole world is working on the same platform. Telemedicine, e-health, m-health are becoming more and more popular day by day [18]. For these distance services, one has to know the common language for which English is preferred all over the world [19]. But in those cases, as English is the second language in many countries and often the doctors, patients, and also biomedical engineers have lacking in English, a biomedical engineer should handle these situations professionally and try to communicate softly with his coworkers (doctors, nurses, technicians, administrative personnel) so that the honor and dignity of biomedical engineering increases (canon – 6). Also, talking in workplaces and after work, help to make a good relationship among colleagues [20]. For example, to remove/reduce the sleeping problem called obstructive sleep apnea (OSA), oral appliance therapy (OAT) is very effective and mostly used. To know for whom this therapy will work and for which people it will not work, how efficient this therapy is for a specific person, research is needed. In that research group, doctors, nurses, staffs, sleep specialists, patients, and computer engineers work with biomedical engineers. So, in that case, a biomedical engineer has to deal with different classes of people; he should be calm with his behavior and be friendly while talking to them so that everyone can understand his language and be properly instructed (canon- 1, 5, 6).

As a part of engineering practice, a biomedical engineer may need to take the lead of purchasing equipment where he deals with the administrative body who often have limited knowledge about biomedical equipment specifications. In that case, the biomedical engineer should be calm and friendly to them and try his best to make them understand the equipment, its uses, importance, and warranty/guarantee so that a friendly environment is created among the colleagues. For example, a biomedical engineer feels the need to buy an electrocardiogram (ECG) machine for servicing the patients. Now as a leader of that purchasing team, the biomedical engineer should inform the management body which company produces the best quality ECG machine, what should be the lead number of that machine, where should it be placed, and how much revenue can be earned from that machine. In that case, the language problem is not about the English and French rather this problem is about technical language and general language. General people often have a very limited idea about technical matters but they are part of the team. So, one biomedical engineer should be friendly to them while explaining these technical issues. In that case, a biomedical engineer should maintain canon no 2 and 4 and also 3 if applied.

To conclude the language barrier issue in the biomedical engineering field, it can be said that for better healthcare, diagnosis, and treatment, language is one of the most important parts. It is reported that because of language, misdiagnosis, delayed treatment, incomplete understanding of the patient's

condition, the risk of medication errors, and complications arise [21]. In aircraft, more than 60% of incidents happen because of human error [22]. According to the report of the National Aeronautics and Space Administration (NASA), among the first 28,000 reports, more than 70% were found with communication issues [22]. So, the language barrier and communication problem is a severe matter in all fields especially in the case of biomedical engineering because it is directly related to patient safety. The situation may come like that the colleague does not understand the engineer's language either because of technical problems or the common language problem. As stated, engineers play a great role in society [13], with a colleague should be calm and friendly while communicating, ensure that all the colleagues with whom he is working understand his language properly. If they misunderstand anything, he should be passionate to say again. But if the situation is like that, he cannot make his colleague understand his issues, then for the engineering dignity and social benefit, he should inform his manager so that nothing bad happens because of the language problems.

Moreover, a biomedical engineer can suggest to his supervisory committee to arrange staff training on the basic technical language so that it is well understood by all the team members. And also, he can suggest training in a common language for the same purpose. Additionally, now a day's language translator is very popular which can help to remove language barriers. More than 200 million people use Google translator every day for their benefit through this translator has some limitations.

Sometimes the administrative committee can have no time to know and understand the works of biomedical engineers in detail rather they want the benefits from the project only but there may be some issues with the engineering team. In that case, the administrative body can hire a third party who has experience working with biomedical engineers and have knowledge about both the technical language and have fluency in the common language. This interpreter can a good role to remove the language barrier in the job field.

Lazy Coworkers: It is found that if coworkers are lazy, then the team's productivity is less than the assumed [23]. This poor performance can lower the team's dignity; so, a biomedical engineer should explain to his colleague respectfully, try to make him understand that his performance is affecting the whole engineering dignity along with the company's goal (canon – 6) [23]. In the field of biomedical engineering, one engineer work with different categories of people, and often every colleague has some dependency on other colleagues. In that case, no project is complete if all the coworkers do not cooperate. For example, in OAT research, patient data is taken by the sleep specialists, doctors, nurses, and technicians; with these data, the biomedical engineers do the necessary image processing, analysis, and computer programming (if needed). Combining all the efforts given to the project by different colleagues, a good result comes out. So, an engineer is dependent on other colleagues for their tasks. The engineer should talk to the colleagues if they are lazy [24]. He can suggest to the colleague to make a "to-do list" for every day or

every next day that should be done within the time. But in that case, he should be friendly and calm in his approach, try to make them understand that their laziness is hindering the project goal (canon 1, 6). But his feeling should not fester and be assertive. It should be kept in mind that dealing with their laziness is the supervisor's responsibility [24].

It may happen that the lazy coworkers will not change their behavior. In that case, one biomedical engineer should not lose his temper and try to keep a good attitude with them [25]. If he assumes that his coworker's laziness may hamper the project deadline then he should talk to the manager and ask for help [25]. In the meantime, an engineer should keep proper documentation so that in the future no responsibility comes to his shoulder. If the supervisors warn the lazy coworkers, then it is predictable that they will be more active. But it happens that the boss does not pay any heed to the complaint or the colleagues do not follow the guidelines of the supervisor, then the engineer should keep good documentation and attitude so that in the future, for any problems, he is clear [24].

Sometimes one colleague may ask an engineer for help; to do his parts of the work. In that case, an engineer should say "No" to his request and act busy in front of him [25]. If the engineer does his tasks, then it will make him lazier, and also, he (lazy coworker) may complain about the task. An engineer may suggest the authority to use mobile apps or websites like DeskTime, Hours, Timecamp, Time Doctor, Toggl, Hubstaff, Primavera, and Microsoft Project, etc. to track everyone's tasks performance [26]. It may help a lot to make the lazy colleague active and clear to the authority about everyone's performance with proper, impartial documentations.

A biomedical engineer can suggest to the administrative committee in the meeting to arrange a staff ranking system based on the activeness and they can hang the ranking notice on the notice board showing proper respect and pride to the most active staff. Prize money can also be given to the most active member of the group. This can encourage the team members to be more active on the job.

Disagreeable Colleagues: Generally disagreeable people want more power and also, they encourage others to be more disagreeable [27]. If the disagreeable people have more power, then they can use it for violent activities [27]. It is found that highly disagreeable people damage team performance [28]. In the workplace, biomedical engineers may face disagreeable coworkers who make the situation unpleasant. Sometimes it happens that one officer assumes something minor that another engineer count as important. For example, for ECG data analysis, one engineer may say that they can use the previous data for the research as it will take time to get new data. The coworker may refuse the proposal and can say that because the technology is upgraded, the ECG machine is also upgraded and that's why they should take new data. In that case, both of them should think about it, give their opinion in a calm and friendly way. As an ethical biomedical engineer, one should calm down and increase self-awareness, think outside the box, allow the colleague to formulate the new question that makes new data, prepare more useful data and generate more acceptable

solutions [29]. But if one coworker is disagreeable at every point and does not pay any attention to others, then it is the second one's matter. He should think it twice; is his coworker doing the right thing or not. If he finds that his coworker is doing wrong as previously, then he should take help from the management and officially inform them about the situation. But informing the manager about it is the final stage solution and everybody should know that they should always be calm with their comments and opinions (canon-6) [24] but to follow canon 6, one should not compromise canon 1-5.

Office/workplaces are the places where the job holders spend more time compared to their families. So, a friendly behavior/environment is very necessary for better performance and for fulfilling the company's goal. One engineer should not involve the managerial body to deal with the disagreeable colleague unless the situation is worst and is highly necessary [6]. Sometimes one biomedical engineer may face some minor problems with a colleague who does not agree with him. The engineer should cooperate with his coworkers if the decision of the coworker doesn't affect the project significantly (canon 1-2). This is just to keep a good and friendly environment in the workplace. Suppose a team will do a biomedical signal processing task for which there are many procedures like filtering, Statistical signal processing, Frequency domain analysis that can be followed. In this case, one may prefer filtering and the other may choose frequency domain analysis. As an ethical person, one biomedical engineer should agree to the colleague if the project value does not decrease and he can maintain all the six canons. As a biomedical engineer who works with versatile colleagues, should be passionate and try to make a good friendship for the honor and dignity of engineering.

Generally, the colleague becomes disagreeable when there is a bad relationship among themselves. So, if it is possible to make a good friendly environment among the colleagues then this problem will be decreased. To do so, extra activities like gossiping during the lunch break, having lunch together, joining the birthday party, hanging out after office hours can be helpful.

Bullies: Bullying is common in schools where it is described as "staggering", pervasive, and widespread [30]. It is believed that bullying is the most prevalent form of violence and by this, a greater number of students get affected [31]. This childhood behavior also exists in many adult people and also it grows with age [31]. As per the statistics of the Workplace Bullying Institute (2007), almost 37% of American workers have experienced bullying of different forms [32]. Coworker's bully causes an engineer anxious and it gives him stress [33]. Because of bullying, disagreement between colleagues is created. As a biomedical engineer, one should know that there is no bullying in corporate life/workplace. So, he should restrain from this whatever the situation is. But if the coworkers do bully him, he should be friendly to them, talk to them directly and make them understand the issue, remind them that bullying is forbidden in corporate life (canon - 6).

One engineer should not feel bad or think of him isolate from the group because of bullying. Also, he should not go to his

unethical colleague's level. If the problem is crucial, he should discuss it with his mentor with proper document/proof, report it to his supervisor. And if the situation is worst then one engineer should take a legal step against his colleagues/supervisors for bullying [34].

Gossipers and Trouble Makers: Gossiping is seen as a good thing in corporate life but with a limit also. In some professions like nursing, gossiping is assumed to be a necessary evil to reduce stress [35]. It also gives them psychological strength while working [35]. But problems arise when it is beyond the control and make trouble at the workplace. Nothing excessive is good. Gossiping is worse than stealing something as it steals someone's dignity and honest reputation in many cases [36]. So, the manager has to take action to reduce the gossiping hours where it can be a reason for poor job performance. Gossip is seen as an anti-norm in almost every society and for maintaining canon 6, every jobholder should keep them restrained from it [37].

Gossip is good if it is under control but generally it makes an unfriendly environment if it is continuous without limit [37]. On average, a job holder expends 52 min a day on gossip [38]; no problem with that in case of colleague relationship but if an engineer assumes that his colleague may create an unpleasant job environment by their random gossiping, he should restrain from that and act as busy with that specific colleague. Also, some coworkers gossip at the time when another person is busy with his work. In that case, he should mention that he is busy and does not have time to gossip. But he should remember that he has to be friendly and peaceful while speaking to them.

Maximum rumors and false information are spread by gossiping. To avoid unnecessary and excessive gossiping, one engineer should try to avoid participating in gossiping in a friendly manner. If the coworker starts gossiping by saying a negative thing, he should say something positive so that the colleagues do not feel the interest to spread the news anymore. When a topic for gossiping comes, one engineer should avoid saying something about his private life; personal life is not a matter to talk to colleagues. When talking to colleagues, one should talk about that topic, not on the person who comes out while talking; deal with the topic/issue, not with the person. While gossiping with coworkers, one should focus on the solution, not on the problem, and never take the matter of gossiping on his heart. Gossiping may affect the project deadline in the field of biomedical engineering. So, every biomedical engineer should think about their productivity, performance, and output while chattering with colleagues. If he finds that the colleagues are disturbing (many times colleagues are from different backgrounds and have less pressure), he should talk to them in a friendly manner and try to make them understand that he does not have time to chat now. In excess cases, he can talk to the management which is not suggested in normal cases as it may affect the good environment. In this also, staff training can be helpful as in this training, the staffs are reminded again and again about the bad effect of gossiping.

Whiners and Complainers: These colleagues always see the negative part of anything, be excessive complainers all the

time. These types of people always want to take more credits for any task by doing less work [39]. Generally, for any project/task in the field of biomedical engineering, people from other departments are involved and all of them should remember that a project is everyone's credit (team's credit), everyone's responsibility, and no option to complain against one another [40]. If the circle of complaining continues, then nothing good can come out. For example, if a project is failed on OAT where doctors, engineers, nurses, technicians, biomedical engineers are involved, everyone should take the same responsibility. On the other hand, if it succeeds, everyone should be congratulated in the same way.

If biomedical engineers work with a complainer who complains about anything that happens then the engineer should avoid them. But if the complaint has some valid points, he should take them seriously to correct himself. To manage whiners or complainers, one should not write anything because writing does not make the sound like a physical conversation that means he should say something in a way that the complainer can understand his calm and friendly manner. One should talk to them calmly in-person to solve the issue. If it does not work, he should propose to him calmly that they should go to the manager for a solution. At the final stage of solutions when nothing works, he should complain to the managerial body and ask for a solution. To manage the whiners and complainers, one should follow canon 3 if necessary and never forget about canon 6.

If a biomedical engineer is exhausted by the frequent complaint from his colleague, he can suggest the managerial body make an online complaint service where both the complainer's name and the person on whom the complaint is made are mentioned. The staff will use the service to complain about any issues they feel bad about in the workplace and the managerial body will investigate the issues. If the issues are right, the guilty person must be punished based on the country's law and the company's ethics but if the complaint is unnecessary or false, then the complainer should be punished for the harassment and lying based on the complaint.

IV. CONCLUSION

In this article, the authors have given an ethical solution to some major problems faced by biomedical engineers in the workplace with colleagues i.e.; Language problem, lazy coworker problem, Disagreeable Colleague problem, Bullying, Gossipers, and Trouble Maker colleague problem, Whiners, and Complainers colleague problem. Every job holder should keep in mind that whatever happens in the workplace, they should not take it at heart, try to find an ethical solution to every problem. Engineers should do all the activities in the job field remembering the six major cannons described in this article briefly. Also, the personal relationship (husband-wife, boyfriend-girlfriend, siblings, neighbors, etc.) should not be reflected in the workplace to maintain biomedical engineering ethics properly.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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