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Solving Rubik's Cube and Ph.D. journey: A multi-faceted endeavor

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Abstract

The purpose of this study was to provide a basic understanding of the Rubik's Cube and its application to pursuing a Ph.D. degree from the aspects of the process, development, and characteristics, as well as creating a vision for the learning. This study followed a narrative research design that focused on the researcher's personal experiences as a method of embodiment research of solving the Rubik's Cube and its application in pursuing a Ph.D. degree. Solving Rubik's cube and the author's Ph.D. journey is a multi-faceted endeavor. For procedural in nature: "No one can reach the peak of the ladder without stepping on the first", is a physiological endeavor. Commitment to success: "Nothing really matters than your will to succeed" is an emotional endeavor. Rewarding Experience: "Rewards may not always be in the form of candy or fancy little things, there are a lot more" is a social endeavor. Acceptance of flaws and limitations: "Acceptance of Flaws and Limitations is a state of the mind. Mind over matter" is a mental endeavor.

Keywords: Ph.D. Students; Ph.D. Journey; Solving Skills; Solving Abilities; Rubik's Cube

1 Introduction

Rubik's Cube, invented in the late 1970s by Erno Rubik of Hungary, is the most famous combinatorial puzzle of its time. The standard version consists of a 3 x 3 x 3 cube, with different colored stickers on each of the exposed squares of the sub-cubes, or cubies. Any 3 x 3 x 1 plane of the cube can be rotated or twisted 90, 180, or 270 degrees relative to the rest of the cube. In the goal state, all the squares on each side of the cube are the same color. The puzzle is scrambled by making several random twists, and the task is to restore the cube to its original goal state. To solve Rubik's Cube, one needs a general strategy, which usually consists of a set of move sequences or macro-operators that correctly position individual cubies without violating previously positioned ones. Such strategies typically require 50 to 100 moves to solve a randomly scrambled cube. It is believed, however, that any cube can be solved in no more than 20 moves (Korf, 1997).

As a traditional brain-training toy well known to the public, Rubik's Cube was utilized by numerous scholars for scientific research and technology development. (Zeng et.al, 2018).

In the same light, a Ph.D. or Doctor of Philosophy is the most common degree at the highest academic level awarded after a course of study. This is the final step in the academic journey starting from Pre-elementary, elementary, high school, college, and master's degree. Given that it leads to the highest degree in education globally, the Ph.D. program has the highest requirements and expectations from students. As a result, studying for a Ph.D. may be a very demanding, tiring, and tedious experience for many candidates. Thus, many have tried but decided to stop for many prevailing reasons. One factor that contributes to this journey being daunting is the independent nature of the program: being a research-based program, the candidates have to do it independently with 'some' help from their research supervisors. This 'research loneliness' may leave the candidates in the dark regarding what they need to do to meet the universities' expectations which themselves are not always made clear (Hunma & Sibomana, 2014).

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This paper is a personal reflection and account that provides a basic understanding of the Rubik's Cube and its application to pursuing a Ph.D. degree from the aspects of the process, development, and characteristics, as well as creating a vision for the learning. Although the future may be uncertain and Ph.D. candidates and aspirants may not know what lies ahead of them, this study will somehow help to prepare them by providing tips on how to overcome specific obstacles and hurdles in a manner similar to how Rubik's cubes are solved. Thus, this study.

1.1 Research Questions

The main thrust of the study was to investigate Rubik's Cube and its application to pursuing a Ph.D. degree. Specifically, it sought to answer the following questions:

- How are solving Rubik's cube and Ph.D. journey related?
- What codes could be emerged from the experiences of the researcher?
- What themes could be emerged from the experiences of the researcher?
- What framework can be developed from solving Rubik's Cube and pursuing a Ph.D. degree?

2 Material and methods

2.1 Research Design

The researcher employed a narrative research design that focused on the researcher's personal experiences as a method of embodiment research of solving the Rubik's Cube and its application in pursuing a Ph.D. degree. The researcher used this qualitative research design to capture the experiences and the meaning-making process. A narrative study is a study of "the ways humans experience the world" (Clandinin & Connelly, 1990, p. 2). It gives the researcher insights into the phenomenon (Creswell, 2012). In an educational research effort, a narrative study is used to explore the experiences of an individual. Narrative research comprises many procedures, including gathering data through the collection of individuals' stories, reporting their experiences, and chronologically ordering the meaning of those experiences (Creswell, 2013).

2.2 Research Sampling

Since this study is qualitative in nature and focused only on the researcher's personal experiences, the research sampling is no longer applicable. The researcher is the lone sample of this study, and experiences in both solving the Rubik's and the Ph.D. journey were documented using a reflective journal and learning logs.

2.3 Data Gathering Procedures

The step-by-step procedure for solving the Rubik's cube was documented. Every minutiae detail and trivial occurrence was recorded. These served as the journal. The journal was used to reflect on the experiences which became the basis for learning logs. From these, personal reflections and narratives were gathered and consolidated.

2.4 Analysis Plan

Thematic analysis was used to analyze the data, particularly qualitative data. It emphasizes on identifying, analyzing, and interpreting patterns of meaning from qualitative data, thus, from my personal experiences. To come up with a thematic analysis the following steps were employed: First, is the separate listing of experiences from solving Rubik's cube and my Ph.D. journey. I closely examined both sets of data to identify commonalities in topics, ideas, and patterns of meaning. Second, I got a thorough overview of both sets of data. Taking initial notes was undertaken to segregate information and data. Third, Coding of data or information. Those with similar contexts were coded, reflected on, and further analyzed. The data were collated into groups identified by the code. Fourth, generating themes. These time codes were combined into a single theme. In this stage, some codes were discarded due to vagueness and irrelevance. The fifth and final step is defining and naming the identified themes and forming categories from among the themes.

2.5 Ethical Consideration

This study recognizes the importance of intellectual ownership of work and avoidance of plagiarism or the direct copying of one's work without proper citation and acknowledgment to the author. The researcher likewise ensures the correct discussion and analysis of gathered information, research methodology, and data collection method, among others.

The results of the study are free from any form of bias. Rejection and selection of the data that were discussed are likewise avoided in the study (Walliman, 2011).

3 Results and discussion

There were four main codes that emerged from the personal experiences of the researcher:

- Procedural in nature
- Commitment to success
- Rewarding Experience
- Acceptance of flaws and limitations

From these four main codes, themes were derived.

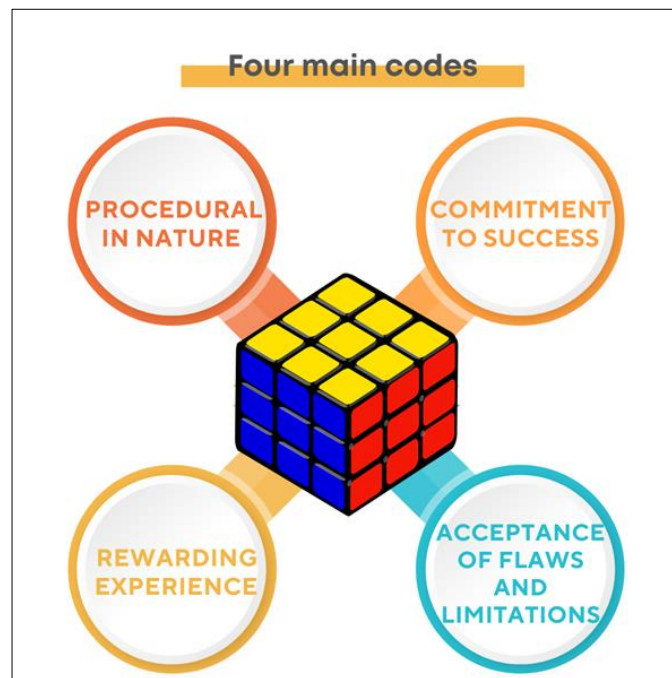


Figure 1 Four main codes from solving Rubik's cube and Ph.D. journey

3.1 Procedural in Nature

“No one can reach the peak of the ladder without stepping on the first”

It was one beautiful Saturday when solving the Rubik's cube was announced in the class. I became very anxious. Many people's childhoods were influenced by some of the most well-known toys, like Rubik's Cube, Tamagotchis, Pokemon Cards, and others. But not for me, definitely. It's quite mind-blowing, especially for someone who struggles with puzzles. I followed six steps in solving the cube. The beginner's method or Layer by Layer: Step 1: Create Bottom Cross; Step 2: Solve Bottom Corners; Step 3: Solve Second Layer Edges; Step 4: Create Top Cross; Step 5: Solve Top Corners; and Step 6: Solve Final Top Edges. But before I even start on these big steps I have to scramble the cube first. I have to start from chaos to restore order. Then, I chose a strategy for solving the cube by assembling different combinations from various sources. I have several resources before I was able to learn it. I used the TikTok app to watch a few quick Rubik's cube tutorial videos. TikTok is known for short video clips with easy-to-understand/ clear directions in the Tagalog language. I take my cube out and begin the process of solving it while following the instructions in the videos. Unfortunately, I can't follow. Some contents are also unreliable and fraudulent saying “the easiest steps to solve a cube” or “solving Rubik's cube in less than a second”, but which are only posted to get attention and views. Actually, not just some of them, but many of them turned out to be fake! I had only borrowed the cube from my nephew, so he's my second reference, I decided to ask him for help so he can teach me how to finish the cube without damaging it. He explained to me that the basic strategy for solving the cube is to solve it in layers. I have to complete each level before continuing. There's the foundation, the first level, the second level, the third level, and the roof or top. To be very honest, King is not a good teacher. He's one of those who can solve the Rubik's cube very fast, really talented and skillful but had a hard

time explaining how it's done. He is aware of this, I suppose. So rather than telling me how to do it, he decided to first show it to me while I watched and took notes. He then reshuffled the cube for me to follow through. Again and again and again till I succeeded. We worked on it all day. The following day, I attempted to solve the cube once more, this time on my own. I got stuck on the third step, though my notes are open. In any case, I'm still delighted that I was able to go to that stage. It wasn't simple. Every action modifies the final result. My last resource is Youtube for instructional videos. There are surprisingly many videos available for learning. "EASIEST TUTORIAL TAGALOG" was the one with the most captivating YouTube thumbnail, so I went with that. Definitely great assistance! I managed to complete my cube in a half-day.

Although there are a variety of methods to solve the Rubik's cube, the logic behind the puzzle remains the same: you have to scramble it to start, execute steps to solve the puzzle, then when you're through you'd like to start anew. Finally, after several attempts and sources, I was able to finish solving the Rubik's cube with ease, I supposed.

Contemplating my experiences in solving the Rubik's Cube and pursuing a Ph.D. degree are quite similar. Officially, my Ph.D. story began in May of 2022 when I started my online class for the third term of A.Y. 2022-2023 at De la Salle-College of Saint Benilde. But perhaps my journey had already started when Dr. Ma. Corazon Reyes, Chair of SHRIM Graduate Programs interviewed and welcomed me to the program, in July of 2021. Unfortunately, despite how much I wanted to begin my journey that year, my request for study leave and a scholarship from the institution with which I am involved has not yet been approved. I thought it was going to be a short process, only to find out that the approval of my request was only from the screening committee and I still have to wait for the Board's approval. I waited patiently and after almost a year, I got the approval. It was a process I have to make, the starting point that will lead me to my Ph.D. degree— a journey full of surprises. Finding out about the Doctor in Tourism and Hospitality Management program also took a process. I went on asking colleagues and friends from several Universities and Colleges about schools that offer Ph.D. in Tourism. I had some inquiries through emails and calls even with schools abroad until my boss- the chairperson of our department found De la Salle- CSB. I immediately took my chance to apply.

After enrollment, is a step-by-step procedure following a map- the curriculum. It's like a flow chart. First, in the first year, I have to finish 24 units of coursework which included eight subjects. Second, if I pass all the coursework, then I can take my comprehensive examination. Third, if I succeeded with my comprehensive examination, only then I can enroll in dissertation writing. In taking these steps, there are also baby steps to make. Before the start of every term, there is an orientation and a discussion of the syllabus and requirements. I went to the stage of adjustment to my new environment, meeting new classmates and professors. I'm new to the class and don't know anyone. Again, this is a process I have to make. Afterward, we proceed with class discussion and reporting of both synchronous and asynchronous sessions. Looking for references, researching, watching videos to aid learning, and more. Some sleepless nights, managing time on personal and professional matters, maybe a little emotional breakdown, and stress. Then eventually, without you knowing, the term will soon end with the submission of final requirements and a term-ender program/ activity. If I hope to complete my degree, I have to deal with all these steps. I can pause for a while, but there's no backing down because I wish to reach the final step- one special day on stage in my toga. Of course, learning will not stop at that stage. Learning will continue as I start to discover new things again. Maybe a second Ph.D. or Master's degree? Who knows!

Procedural in Nature. No one can reach the peak of the ladder without stepping on the first. This learning is evident in both Rubik's cube and my Ph.D. journey. Both have lots of twists and turns but the routines could be cyclical, ladderized, or spiral in nature, you could reach the top by focusing on your goal and pursuing the step-by-step procedures until you get to the top. This impression is quite relative to the theory of change (Connel,1998). He specifically laid out plans on how to develop a Theory of change in a participatory and collaborative process. These involve all the people you will come in contact with. People that could be included in the process are the potential beneficiaries of the initiative and all other persons who possess expertise or knowledge in the area that the change will address.

3.2 Commitment to success

“Nothing really matters than your will to succeed”

Solving the Rubik's cube can be a lonely endeavor. When I was playing alone for the first time, I felt hopeless. I remember, when I first attempted to solve the Rubik's cube, it took me an hour and a half but was still a failure. I looked at the mirror and said: “Bakit hindi ko magawa? Ang hirap naman, ayoko na nga!” (Why can't I do it? Quite difficult. I quit!). But after a moment of thinking, I smiled and said: “Naku kaya ko to! Simple lang yan” (I can do it! This is just simple.). True to my words, after several attempts, several methods, and several people who helped me along the way,

I was able to do it. I learned that the cube can take people of various ages, minutes, hours, weeks, or months to solve depending on their interests, motivation, and will. An algorithm or set of steps is required to get closer to a puzzle solution. With my nephew's assistance, I could restore it for a day, but it was difficult to do it again on my own. Difficult but not impossible. Try and try until I achieved my goal. Not giving up until a solution is found. A problem could seem messy before it is resolved, but with the will to succeed, I can find the answer. Progress comes in unexpected leaps.

Just like pursuing a Ph.D. degree. If you wanted to succeed, you will do anything to beat the odds. Accomplishing webinars, tourism plans, business plans, projects, reports, and several tasks were made possible because of your willingness to accomplish things. While the first term of my studies was dominated by uncertainty, I was enthusiastic about my Ph.D. in general. There may be sleepless nights and countless works and assignments, but just like solving a Rubik's cube "I can do it! This is just simple!"

Commitment to success. Nothing really matters more than your will to succeed. This adage is true to both solving Rubik's Cube and my Ph.D. journey. The power should be within me. The power to survive lies in me and I can do all things if I am determined and compassionate about succeeding. Relative to this is the study conducted by Stansbie and Chang (2018) which emphasized that attitudes are evoked by behaviors. This mechanism should strategically be applied to practical implications to provide engagement, thus commitment.

3.3 Rewarding Experience

"Rewards may not always be in the form of candy or fancy little things, there are a lot more"

How many twists will it take to return the small cubes back to where they started? I've been asking this myself while solving the cube for hours. I am highly determined to solve the puzzle. I first practiced and learned the right and left algorithms. For both algorithms, the four basic moves in Tagalog are— Taas, Tulak, Baba, and Hila. I'm not sure how long it will take or how I'll go about doing it at first. But every time I got to finish a layer is a rewarding experience. I remember saying, "Yes" with a wide smile on my face. Those little steps soon made me finally shout... "Tapos na! /it's done!" The moment I got to look at the solved Rubik's cube was quite enjoyable. My breath was moving too quickly, my heart almost skipped a beat, and I almost leaped up from my seat. I showed it to my husband after I came back to my senses, and he laughed so hard. He requested that I share with him the combinations and fundamental algorithms I used. Fulfilling is an understatement for what I felt when I finally solved the cube. It's an incredible feeling. I was able to proclaim with pride: I figured it out. This is indeed something to be proud of and a very happy moment for me. Clearly, overcoming obstacles and achieving goals requires patience and determination. But apart from this intrinsic reward, I also got an extrinsic reward from my cousin/second mother. She treated me on a coffee and ramen date as a reward for a job well done. Yes, rewards can be achieved at the end of the game.

Just like in pursuing a Ph.D. degree. Getting good grades as I successfully finished my three subjects the last term gave me a sense of growth and accomplishment. I was so happy because these are from my hard work and sweat. I was so delighted already as I finished a term, what more once I finished the degree. Undertaking a Ph.D. has been the best decision I've taken in my life, although it has not been an easy road. It's a roller coaster ride, with inspiring, generous, and supportive Professors bringing me excitement and fulfillment with every well-appreciated submission of accomplishment in class. I remember a simple "very good" coming from my Professor is already enough to validate my worth as a student. After all, I still had a part-time job, as an event organizer, with a bunch of other deadlines I had to make. My weekends were far from free, and I had to catch up on sleep and rest. So ending my term with three 4.00s is really a happy ending. But apart from this intrinsic reward, I also got an extrinsic reward from my husband, he treated me out to a pizza and milk tea date in Tagaytay. Yes, rewards can be at the end of every term. This time I was certain of one thing – I wanted to see the end of my Ph.D. By then, I can truly reap the fruits of my labor.

Rewarding Experience. Rewards may not always be in the form of candy or fancy little things, there are a lot more. As I contemplate the similarities between solving Rubik's cube and my Ph.D. journey, I realized that to succeed, I need a support group. My nephew, my husband, my family, friends, and my classmates with whom I regularly talk and update about my progress. Helping, and pushing me to strive hard. Coaching me every step of the way. Alone, I can do little but with others, big things can be accomplished. I became even more passionate about my journey, after meeting and making friends with other Ph.D. candidates from various universities across the country. Our class is composed of cooperative, promising, intelligent, and hardworking students. Pursuing a Ph.D. degree can be a lonely endeavor when you study on your own. This term, I was able to form a mini study group, a couple of classmates who meet regularly to critique and compare each other's work and be productive and successful together. We shared the joys of milestones reached and attempted to collectively solve obstacles along the way. It's special collegiality and developing friendships,

that support and inspire one to succeed. It's not a competition but a healthy family helping each other towards a common goal. Finally, rewards may not always be candy but it also pays to receive one.

This impression is backed up by the reward theory which states that people are attracted to individuals exhibiting regarding behaviors to them or whom they associate with rewarding events (Drayer, et.al., 1997) similarly the incentive theory of motivation, Kendra (2020) has a bearing on this findings. She states that, According to one theory of human motivation, actions are often inspired by a desire to gain outside reinforcement and suggests that behavior is motivated by a desire for reinforcement or incentives. The value of an incentive can change over time and in different situations," writes Stephen L. Franzoi in his text *Psychology: A Discovery Experience*. "For example, gaining praise from your parents may have positive incentive value for you in some situations, but not in others. When you are home, your parents' praise may be a positive incentive. However, when your friends visit, you may go out of your way to avoid receiving parental praise, because your friends may tease you."

3.4 Acceptance of Flaws and Limitations

“Acceptance of Flaws and Limitations is a state of the mind. Mind over matter”

In solving Rubik's Cube, there will always be that decision you regret making. Cutting corners can be risky. Once you make the wrong move, you will have difficulty moving on to the next step. I even had to stop and think for a long time before making the next move. I was so afraid to make a wrong turn that I can't reverse. It's quite a little hard to accept that at my age, I can not do it on my own. So even though there are several references dedicated to solving the cube, I tried doing it on my own because I wanted to appear competent. I gave it a go, made a few hesitant movements, and then stopped. I felt discouraged and hopeless. So I stepped back just to do other important things. Back in my mind, I wanted to try again. It's just that I'm not sure where to start again. There I realized that as a beginner, I can make mistakes. This made me believe that sometimes taking a few steps back is all it takes to progress. Amazingly, by failing coupled with my persistence, and patience, I was able to solve it. Yes, Rubik's cube is not for everybody. Only less than 5.8% of the world's population can solve the Rubik's Cube, according to the Rubik's website. Fortunately, it's for me.

Just like in pursuing a Ph.D. degree. I usually encounter problems in complying with all academic requirements on time. I sometimes fail to manage personal and professional time at some point. I sometimes wanted to quit and even asked myself: “Ano bang ginagawa ko dito/What am I doing here?” Life got in the way and my Ph.D. was abruptly pushed aside for two weeks and more. It's the season of disruption for me in many ways. Some major life events during this time include losing my father-in-law whose like a real father to me, planning on selling a property, moving back to my parent's home for some personal matters, and looking after a brother- I don't have parents anymore as many knows. I found it increasingly difficult to look at my academic requirements. Procrastination was my only agenda. I focused on vlogging and watching random movies on Netflix. I wish I had the courage to walk away from it all. I prayed, consulted my family, pull myself together until I became more stable emotionally. I tried to reconnect with my academic requirements, although it was still out of whack. What made me enroll in the first place redirected me to where I should be going. The trick is not to get stuck in that problem. The nature of the Ph.D. journey is such that things will not always go according to plan. I learned to stay calm, take some time off, and then carry on. I accepted the fact that I'm just a person who can get tired. There are those days when you're drained and can't accomplish things. But that doesn't mean that you'll always be someone who doesn't know things. The beauty of studying is being open to new learnings and experiences. You may not know it today, but tomorrow you'll be better. The next day or days, you'll be an expert on this. And yes, Ph.D. is not for everybody. People have different abilities and strengths. The same thing as not everyone can play in the NBA, write songs, be an accountant, or even work on an assembly line.

Acceptance of Flaws and Limitations. Acceptance of Flaws and Limitations is a state of the mind. Mind over matter. This is true in both solving Rubik's Cube and my Ph.D. journey. Both require an emotional balance as social support, and physiological stability but equally important is the stability of the mind by focusing on the right perspective. Problems, limitations, and imperfections are just trivial matters compared to the power of the mind. This impression is similar to the findings of the study by Du, Jian, and Cai Yin (2020) *Owning One's Intellectual Limitations: A Review of Intellectual Humility*. They admittedly revealed that an optimistic judgment about ability and knowledge of oneself may improve one's self-esteem and self-efficacy, which, in turn, may improve performance in real tasks and buffer negative impacts (Bandura, 1997). However, excessive pretense or inability to evaluate one's ability accurately may lead to reluctance in seeking others' help or accepting new and better ideas (Danovitch et al., 2019). More importantly, pretense and arrogance may give rise to various interpersonal problems (Peters, Rowat, & Johnson, 2011).

This framework will serve as the theoretical stance of the output.

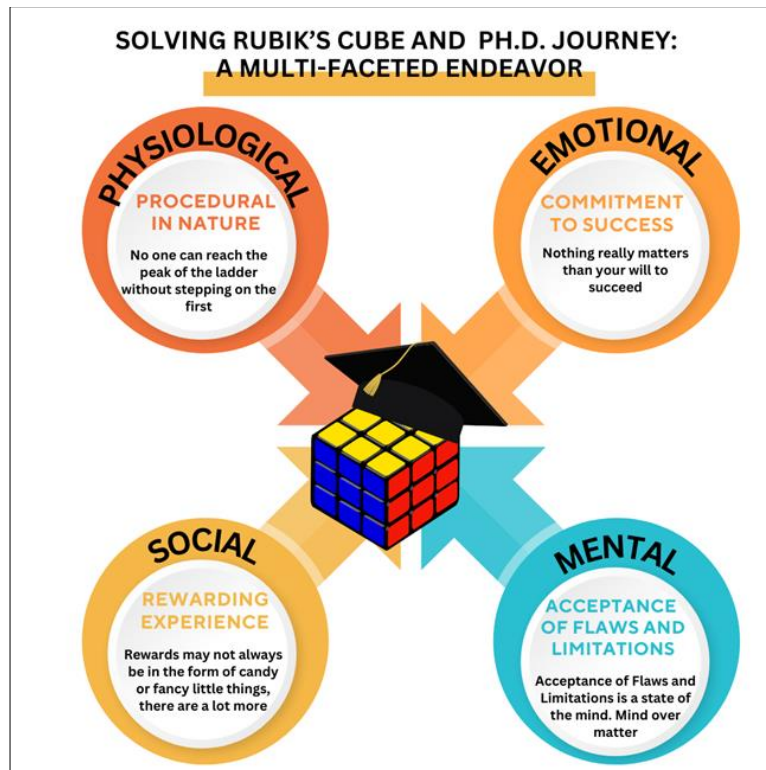


Figure 2 Theoretical Framework

4 Conclusion

On the basis of the following codes, and themes, made me conclude that solving Rubik's cube and my Ph.D. journey is a multi-faceted endeavor.

- For procedural in nature: “No one can reach the peak of the ladder without stepping on the first”, is a physiological endeavor.
- Commitment to success: “Nothing really matters than your will to succeed” is an emotional endeavor.
- Rewarding Experience: “Rewards may not always be in the form of candy or fancy little things, there are a lot more” is a social endeavor.
- Acceptance of flaws and limitations: “Acceptance of Flaws and Limitations is a state of the mind. Mind over matter” is a mental endeavor.

Compliance with ethical standards

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