Concepts in Engineering Design

Concept Generation

Reference: https://www.cleverism.com/techniques-idea-generation-mind-maps/

How did ideation technique originates?

- The goal in designing a new product is to create an innovative solution that will be sold in the marketplace and produce revenue.
- The goal of concept generation is to produce new ideas by looking at different ways to solve a problem. There are many activities and techniques that aid in the generation of ideas, but none is more important than controlling the criticism and evaluation of the concepts.
- It is vitally important to evaluate product concepts in order to determine the solutions that will result in the best possible product. However, evaluation is best conducted in terms of the design objectives and at the conclusion of the Concept Development and the Refinement Phases.
- At these points, product concepts are sufficiently developed enough to be judged and improved to the next phase.
- Criticism or evaluation before the conclusion of the Concept Development Phase impedes the focused and uninhibited sort of thinking that is needed to generate new ideas.

Concept Generation

- If ideas are criticized as they are generated it becomes very difficult to think conceptually. In that case, the person generating ideas will concentrate more on the judging criteria and less on forming ideas.
- Criticizing and evaluating new ideas can act as a correctness filter at a stage in the process that requires loose, quick, not fully developed ideas in order to avoid reapplying existing solutions.
- Criticism here includes self as well as team criticism. Self-criticism occurs for several reasons.
- One reason is that self-criticism may provide a way to avoid others' criticism or being embarrassed by others' criticism.
- Another reason is that self-criticism may be based on the drive to be competitive and the thought that an idea is not useful or "no good" if it is not seen as a "winner."
- In concept generation exercises it is critical to withhold evaluation and all types of criticism until an appropriate number of ideas are generated or a predetermined time has past.
- In this way students gain valuable experience in generating ideas freely, exploring alternative solutions and synthesizing strong, fuller solutions.

Some techniques that will aid student designers to control and relocate criticism/evaluation during concept generation activities are as follows:

- Think of ideas as not having value and that the task at hand is to generate a quantity of ideas.
- Remember that innovation can come from reiteration and the more solutions generated the greater the chance for a new solution.
- Use a "worry sheet" to record distracting, outside concerns during the idea session so your "worries" will not be ignored but addressed later.
- Generate many ideas in order to understanding the interrelationships of the design objectives.
- Remember that criticism at the right moment is a useful tool for idea generation and that idea generation and selection is somewhat Darwinian, the most capable concept will move forward.
- Remember that preventing self-criticism takes practice. Start by recording the amount of critical comments that creep into the concept generation process. Then begin a concept generation session by wanting to not judge your ideas. There is not a magic solution. It will take focus, effort, and practice to change the habit of early criticism.
- Remember that it is nearly impossible to juggle different objectives of a product in your mind simultaneously; therefore, an initial idea cannot be complete and, as such, cannot be judged.

When the students are conducting group concept generation sessions there are useful techniques that will aid the success of the activity. It is very useful to use an environment that will allow one to five people to focus for an hour, have the participants well fed but not sleepy, discuss the design objectives so that the group is better able to focus, and take as many breaks as necessary. Additional techniques that will encourage success include:

- Select one person to be aware of time, and help the group to remain focused.
- Encourage the group to be open and share ideas and thoughts. Have the members of the group share a personal thought or concern in order to encourage camaraderie.
- Enforce the evaluation of the ideas in terms of the design objectives at the appropriate time.
- Focus on one particular aspect of an objective for a specific amount of time, +/-twenty minutes to facilitate the generation of solutions.
- Use a comfortable medium-- pen, pencil, tape recorder-- to record every idea.
- Make a Problem Sign and put it in front of the participants in order to help the group focus on the objective.
- When the participants seem stuck or out of ideas, it is best to take a break, change the subject, medium and/or location.
- To conclude the session, ask the participants to consider the most ridiculous idea. This will permit and encourage free thinking as the idea is considered useless from the start.

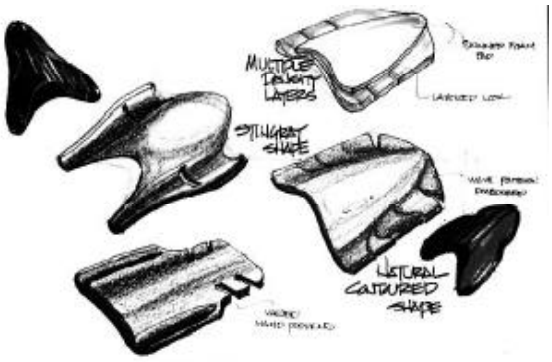
There are countless examples from industry that show the benefit of successful concept generation in the product development process. One has been chosen to discuss here. Example shows the importance that product definition and concept generation in a criticism-controlled environment can have on the process of developing new products.

Speedray by Zura Sports, Inc.

- The Speed-Ray kickboard was designed by Design Axis, Inc for Zura Sports, Inc.
- When the Speed Ray was developed, Zura Sports was a new entrepreneurial company staffed by designers with a strong personal experience in competitive swimming.
- The design team identified the swimming kickboard market as static and unchanging and, as such, ripe for innovation.
- The team defined the product through examining the practice techniques of coaches and the body dynamics of competitive swimmers.
- In addition, the team researched floating materials, water flow, manufacturing practices, and aquatic creatures.

- Based on their research, the design team defined the kickboard as being able to 1) Enhance the swimmer's grip, 2) support the swimmer's elbows, 3) encourage changes in kick patterns, and 4) present a quick, aquatic image.
- With the product defined, the design team set to the task of generating ideas.
- The designers pretended to swim in order to visualize practice routines and encourage the generation of concepts.
- Pictures of fish were posted on the wall as reference material for the development of forms and colors.
- The concept generation sessions were focused and stayed to the prearranged schedules with critical comments being noted and promptly negated.
- Additionally, all the participants in the concept generation sessions agreed that the concepts would not be evaluated until the wall in the conference room was filled with product ideas.
- This practice aided the group to focus on generating many ideas and not generating a single, best idea.
- The concepts were wide-ranging; some rugged and finned, others were dramatic, resembling a manta rey, others exhibited pronounced grips or specific body contact areas.
- The team generated concepts that reflected the vividness of the sport and the aquatic nature of the environ.

- After many reiterations and tested study models, the design team built a near-production prototype and introduced the Speed-Ray at a trade show.
- The response was beyond expectations and the kickboard moved directly into production.
- The Speedray has been noted by Popular Science magazine as the "Best of What's New," and has received an IDEA Gold Award from the Industrial Designers of America and Business Week magazine.
- Zura Sports continues to push for innovation and currently offers over twenty aquatic fitness products for swimmers of all ages.



Concepts in Engineering Design

Mind Mapping

Reference: https://www.cleverism.com/techniques-idea-generation-mind-maps/

Mind Mapping

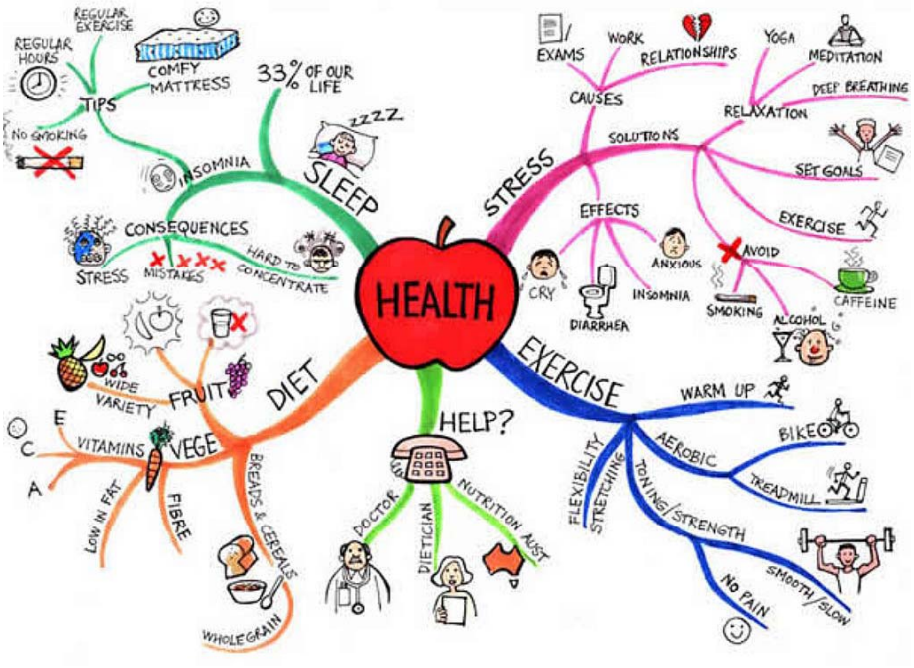
- The Mind Mapping technique was created to be an effective way to produce ideas by association.
- It transforms a huge list of dull or tedious information into a highly organized, colorful and memorable pictorial representation that is in agreement with the brain's normal manner of doing things.
- With respect to creative problem solving, mind maps help to show how different pieces of information or different ideas are connected.
- Discussion topics:
  1) definition of mind mapping,
  2) how did this technique originate?
  3) essential features of a mind map,
  4) how to build your own mind map,
  5) Applications of mind maps,
  6) advantages of using mind maps, and
  7) short note on mind mapping tools

Definition of Mind Mapping

- A mind map is a graphical representation utilized to visually organize information.
- The process of mind mapping involves penning a central theme and coming up with new and associated ideas that branch out from the central idea.
- The central single idea is frequently in the format of an image drawn in the middle of a blank landscape page to which connected representations of ideas such as words, images, facts, figures, concepts or parts of words are added as they are thought up.
- Mind mapping utilizes the concept of "radiant thinking." This means thoughts radiate (branch out) in different directions from a single idea.
- The branches may move forwards and backwards to and from the main (central) idea.
- This is in contrast to "linear thinking" which is a thought process following a step-by-step flow or known cycles where it is necessary to get the response to one step before moving to the next step.
- As is the case with other mapping techniques, the objective of mind mapping is to concentrate attention and to acquire and frame knowledge to enable the sharing of concepts and ideas.

How did ideation technique originates?

- Tony Buzan is the name frequently used in connection with mind mapping.
- It is true that he popularized the term "mind map." However, the utilization of diagrams that graphically "map" information using radial maps and branching, dates back centuries.
- Similar strategies were utilized in the 3 century by Porphyry of Tyros to conceptualize Aristotle's ideas.
- The semantic network was created in the late 1950s as a hypothesis to comprehend human learning that was further revised by M. Ross Quillian and Allan M. Collins at some point in the early 1960s.
- The radial structure of mind maps is similar to that of concept maps, created in the 1970s by learning specialists.
- However, the difference is that the former are made easier by concentrating around a central, single key concept.
- Tony Buzan's argument is that 'traditional' outlines call for the reader to scan information in a left to right, top to bottom manner that is in contrast to the brain's natural propensity to scan the whole page in a nonlinear manner.
- Buzan additionally utilizes widespread suppositions pertaining to the cerebral hemispheres so as to encourage the exclusive utilization of mind mapping in preference to other kinds of note making.



Essential features of a mind map

- There is a single key idea, focus, subject or concept graphically represented in the form of a central image.
- The key themes associated with the idea, focus, subject or concept radiate from the central picture as branches.
- Each branch carries a key word or image printed or drawn on the associated line.
- Other branches, shown as twigs are connected to the main branches.
- The twigs represent concepts of lesser importance.
- The branches create a linked nodal structure.

How to build your own mind map?

If you are using a mind map to get employees in your business to come up with ideas/solutions, you may give them instructions as follows:

Prerequisite: Keep blank paper and colored pens ready. If A4 paper seems inadequate, you can consider A3 paper.

Step 1: Start with the topic

Put the topic, central concept or idea in image form, in the center of an empty page. Space on the page should be used wisely and yet freely so that the brain doesn't feel unbridled, and there is space to occupy more and more ideas as they come. Beginning in the center provides the brain with freedom to move in all directions and reveal ideas/solutions more naturally and freely. It may be more convenient to position the page in landscape orientation because that makes drawing easier.

Step 2: Define the structure

Create the fundamental structure with which you would be organizing your ideas. The structure would include branches radiating out from the central idea and drawn as thick lines. These main branches are termed as Basic Organizing Ideas (BOIs).

How to build your own mind map?

Step 3: Define each branch

Put down a key image or word for each branch as your ideas come. Allow the ideas to flow freely and quickly (long pauses are not to be encouraged) without judgment on whether they are practical or crazy. Also no need to bother about aesthetics. Draw freely and unconcernedly.

Step 4: Highlight the priorities

The concepts of lesser importance can be represented as the twigs and drawn as thinner lines.

Step 5: Extend your mind map by additional ideas

As information and ideas keep coming, connect them to the mind map in a suitable manner.

Step 6: Review and revise

After the first attempt, allow your mind to settle. Once it has, you may want to revisit what you did. Review it and revise and/or reorder it. Sometimes, a different sheet of paper may be required for this.

How about two mind maps?

Another way to mind map and this is for problem-solving, is to create two different mind maps, one each for the problem and solutions. For the problem mind map, the problem would be the main idea represented in the center with causes and aspects of the problem connected by branches. Sub-branches can be used to examine the problem in more detail. For the solution mind map, the solution would be the key idea represented in the center. By way of the main branches, one can provide the routes that would help to solve the problem. One can incorporate organizations, colleagues, resources or techniques that would be of assistance and associated with those routes. Sub-branches can be added as one venture into the details.

Drawing two mind maps makes one realize that a single obstacle could have multiple potential solutions. It is up to the person drawing the mind map and others concerned to find that solution(s) which is most practical, cost-effective and/or time-saving. A final branch may be developed with the selected solution or blend of solutions, with the sub-branches connecting to and from the details of intended method(s) of implementation.

A properly done mind map is very easy to review as it is possible to frequently refresh information mentally just by a cursory glance. The mind map would depict the "shape" of the topic, the comparative significance of individual branches/twigs, and the manner in which facts are connected to one another. Remembering the structure and shape of the mind map can provide cues that would help to recollect the information within the map.

Suggestions / tips / techniques

- Use colors for the whole project. Colors give the mind map extra vitality and arouse the brain's creative and visual faculties.
- Stick to single words or brief meaningful phrases for key words. Too many words would only cause cluttering.
- Similar information, if any, can be clustered together.
- Capital letters are to be preferred to small caps.
- It would be a good idea to make the branches curved instead of straight. Only straight lines in the map may come across as boring to the brain.
- Use as many images as possible. Besides being easy to remember, a picture is worth a thousand words.
- Use arrows to show connections between ideas.

Suggestions / tips / techniques

- If the person wishes and if required, he can annotate the mind map. An example would be providing references to other sources, making them identifiable by writing them down in a different color of pen.
- One should feel free to adopt a personal style as this would boost the creative fire. Information in one section of the mind map may have some connection to another section. If this is the case, the person can draw lines to depict the cross-linkages. This would assist with comprehending how one aspect of the subject impacts another. It is also acceptable to use other visuals such as callouts or speech bubbles to depict the link to the key/central idea or theme.
- The person should stay calm throughout the mind mapping process. This suggestion may not be suitable for an office environment but is good for mind mapping at home. To do so, the person should distance himself from the topic to work on, by taking brief breaks and then coming back to it clearheaded and fresh. A short walk could help. By providing the brain with rest, one will find that it becomes more forthcoming with ideas.

Applications of mind maps

- As is the case with other diagramming tools, this idea generation technique may be utilized to generalize, structure, visualize and classify ideas. It also helps with triggering creativity and creative solutions, organizing information, making decisions and solving problems. Mind mapping is also used for brain storming. Here, ideas are introduced into the map in a radial manner surrounding the central node, bereft of the implicit prioritization associated with sequential or hierarchy arrangements, and in which grouping and organizing is kept for later stages.
- Data collected from mind maps may be utilized to enhance various other applications, examples being search engines and specialist search systems. To achieve this, the mind map may be examined with traditional techniques of information recovery to classify the author of the mind map or documents that are connected from inside the mind map.

Applications of mind maps

Other applications include

- Making notes, whether for presentations or essays, from lectures or from secondary sources such as books;
- Studying and remembering information (it has been propounded that mind mapping can enhance
- study/learning effectiveness by 15 percent more than traditional note-taking;
- Displaying information in a layout that depicts the structure of a subject taken as a whole;
- Simplifying a complicated idea;
- As a mnemonic;
- To team up in sessions of color pen creativity.

Advantages of using mind maps

Mind maps help the user utilize the complete power of the brain, both the left which is more associated with logical and analytical thinking, and the right which is utilized for day dreaming, spatial awareness, color, imagination and a feeling of wholeness. This idea generation technique has several advantages including that it:

- Spurs one on to view the bigger picture;
- Requires less time to develop;
- Consumes less space than notes that are chronologically arranged;
- Allows large topics or projects to be broken down into manageable chunks and this broken-down form, therefore, facilitates effective planning and minimizes chances of forgetting key points and being overwhelmed;
- Increases concentration;
- Helps trigger more associations and ideas by applying radial thinking;
- Provides pleasure to the eyes (once completed, the mind map appears like a mini work of art to those who behold it).

Minding mapping tools

Though in many cases, it is suitable to draw mind maps using the hand, software applications and tools can broaden the scope of mind-mapping by permitting those engaged in the process to map more than ideas and thoughts using information on the internet and computers, such as documents, spreadsheets, images and internet sites. A few of these tools are discussed below:

- iMindMap: This concept mapping software utilizes Tony Buzan's trademark mind mapping techniques to develop maps for project management, brainstorming, creative thinking, organizing, and planning and delivery of presentations. ThinkBuzan developed the desktop application. The tool runs on Mac OS X and Microsoft Windows. iMindMap has focus applications, examples of which are Expand and Collapse Branches and Focus In and Out which can assist with moving around the problem and making the mind concentrate.

Mind mapping tools

- Coggle: This is a freeware web application for mind mapping. Some of its prominent features are real-time collaboration, markdown text formatting, iOS support, sharing with individuals, organizations or through a private link, and LaTeX math support utilizing MathJax. Auto-save and revision features mean it is possible to view how the mind map looked prior to someone who was invited beginning to work with it. The software enables creation of linear and organic mind maps utilizing a keyboard, mouse, tablet computer or interactive keyboard.
- Xmind: Created by XMind Lt.d, XMind software helps with both mind mapping and brainstorming. Apart from the management elements, the tool can clarify thinking, capture ideas, promote team collaboration and handle complicated information for greater productivity. In addition to mind maps, it supports spread sheets, fishbone diagrams, organization charts and tree diagrams.

Concepts in Engineering Design

Brainstorming
Braindumping
Brainwriting
Brainwalking

Reference: https://www.interaction-design.org/literature/article/learn-how-to-use-the-best-ideation-methods-brainstorming-braindumping-brainwriting-and-brainwalking

Brainstorming

Brainstorming is a group problem-solving/ creativity technique, in which a group of people uses their collective intelligence to approach a creative problem. This technique inspires people to come up with creative ideas. Brainstorming sessions should be used at the very beginning of a project and should address a specific question.

Brainstorming was originally discovered in the late nineteen-forties by Alex Osborn. It was developed to inspire employees to produce creative ideas for ad campaigns.

Brainstorming is the most frequently practiced form of ideation. Brainstorming is a great way to generate a lot of ideas that you would not be able to generate by just sitting down with a pen and paper. The intention of brainstorming is to leverage the collective thinking of the group, by engaging with each other, listening, and building on other ideas.

Conducting a brainstorm also creates a distinct segment of time when you intentionally turn up the generative part of your brain and turn down the evaluative part.

You can use brainstorming throughout any design or work process, of course, to generate ideas for design solutions, but also any time you are trying to generate ideas, such as planning where to do empathy work, or thinking about product and services related to your project.

Brainstorming

Brainstorming (or just ‘brainstorm’, for short) has remained the cornerstone of the creative industry for decades and has evolved over the years as experience and learning developed from its variety of applications.

Brainstorming essentially relies on a group of people coming together with their prior knowledge and research in order to gather ideas for solving the stated problem.

It evokes images of exploration, experimental thinking, and wild ideas.

However, all too often it takes the form of controlled sessions where dominant figures assert themselves over others and creativity ends up getting shifted.

Or, in other cases, the facilitator does not succeed in helping the team steer towards the goal by keeping the user, the user’s need and the team’s insights about them in a problem statement – also called Point Of View – at the front of the team’s minds.

Brainstorming

Idea generation, or Ideation, is an art form, which is dependent on appointing an experienced facilitator and having an experienced team.

Brainstorming is about setting a safe, creative space for people to feel like they can say anything and be wild—and know that they will not be judged for doing so—so that new ideas can be born.

The following are some rules, principles, and suggestions to make brainstorming sessions much more user-oriented, effective, innovative – and fun.

Brainstorming rules

1. Defer judgement. You never know where a good idea is going to come from. The key is make everyone feel like they can say the idea on their mind and allow others to build on it.
2. Encourage wild ideas. Wild ideas can often give rise to creative leaps. In thinking about ideas that are wacky or out there we tend to think about what we really want without the constraints of technology or materials.
3. Build on the ideas of others. Being positive and building on the ideas of others take some skill. In conversation, we try to use “and” instead of “but.”
4. Stay focused on the topic. Try to keep the discussion on target, otherwise you can diverge beyond the scope of what you're trying to design for.
5. One conversation at a time. Your team is far more likely to build on an idea and make a creative leap if everyone is paying full attention to whoever is sharing a new idea.
6. Be visual. In live brainstorms we write down on Post-its and then put them on a wall. Nothing gets an idea across faster than drawing it. Doesn't matter if you're not Rembrandt!
7. Go for quantity. Aim for as many new ideas as possible. In a good session, up to 100 ideas are generated in 60 minutes. Crank the ideas out quickly and build on the best ones.

Should you forget Brainstorming?

Brainstorm, as great as it can be, has some obvious weaknesses, most of them human factors.

Whenever a group of people gets together to work collectively on anything, we inevitably find some members dominating over others.

Introverts take a back seat and prefer working away in a quieter selfreflective manner, while extroverts, especially egoistical ones, put a stake in the ground and try to own the show.

Research published in the Administrative Science Quarterly in 1958, Does Group Participation When Using Brainstorming Facilitate or Inhibit Creative Thinking?, seeks to understand whether individual brainstorming or group brainstorming sessions produce better results.

A storm of debate ensued in 2010 when News Week posted an article referencing this research and making a call to "Forget Brainstorming "with others rebuffing this claim and affirming "Don't Forget: Brainstorming Works".

Though the results of the study were based on limited parameters, they do indicate that if group brainstorming conditions are not properly met, they can fail more easily.

Should you forget Brainstorming?

We agree that poorly facilitated face-to-face brainstorms do stifle creativity. We agree that, even when brainstorming is done right, people could sometimes still generate ideas faster when they work alone.

However, if you want creativity, it's a major mistake to keep your team members in solitary confinement where they can't "waste time" listening to and building on the ideas of others.

Here's the problem: Most pieces of research on brainstorming are rigorous but irrelevant to the challenge of managing creative work.

For starters, comparing whether creativity happens best in groups or alone is pretty silly when you look at how creative work is actually done.

At creative companies like IDEO, people switch between both modes so seamlessly that it is hard to notice where individual work ends and group work starts.

Should your Team Brainstorm as a group or as individuals?

Best practice: Switching between the two modes of individual and collective ideation sessions can be seamless—and highly productive.

Alex Osborn's 1950s classic Applied Imagination gave advice that is still relevant: Creativity comes from a blend of individual and collective ideation.

Brainstorming (group sessions) has three siblings which you should get to know: Braindumping (individual sessions), Brainwriting (a mix of individual and group sessions) and Brainwalking (another mix of individual and group sessions).

It's often a good idea to do individual ideation sessions like braindumping, brainwriting and brainwalking before and after brainstorming group sessions.

Braindumping

One of the best ways to progress to more advanced levels of ideation is to start by getting everything that's currently clogging the neural pathways out in the open and freeing up some cognitive space for other synapses, connections, and mixtures to get through.

David Allen, author of the world famous “Getting Things Done” methodology, swears by the braindump as a means to free up mental energy and allow freethinking.

Holding onto your own thoughts, unfinished tasks, or unexplored ideas creates mental blockages and prevents freethinking.

Furthermore, Braindump is an amazing technique to help quiet employees get a voice.

Braindumping – Best Practice

- If you were the facilitator, you’d brief ideation participants upfront on the problem statement, goals and important insights from previous research and findings.
- Then ask all participants to write down their ideas as they come.
- It’s important that each participant does this individually – and silently.
- Provide participants with sheets of paper, idea cards or traditional Post-it notes. Sticky notes aregreat, because they allow people to write their ideas down individually – one idea per note.
- Give participants between 3 and 10 minutes to get ideas they have been thinking of off their chests.

Braindumping – Best Practice

- After reaching the time limit of approximately 3-10 minutes, each participant will say a few words about his or her ideas and stick them on a board or wall. You should avoid initial discussions about notes when team members are presenting them. Ideas that come out of early braindump sessions should be shared verbally with the entire team in order to spark new streams of thinking or combinations of ideas.
- While sticking the ideas up and presenting them, the group will also group duplicates together.
- When all team members have presented their ideas, you can select the best ideas, which you can continue to build and elaborate on in other ideation sessions. There are various methods you can use such as “Post-it Voting”, “Four Categories”, “Bingo Selection”, “Six Thinking Hats”, and “Now Wow How Matrix”.

Braindumping – Best Practice

Sticky notes are great for braindump sessions, because they allow people to write their ideas down individually – one idea per note. After reaching the time limit of approximately 3-10 minutes, each participant will say a few words about his or her ideas and stick them on a board or wall

Brainwriting

- Brainwriting is a technique where participants write ideas onto cards and then pass their idea cards on to the next person, moving those cards around the group in a circle as participants build on the ideas of others.
- Participants perform this technique in complete silence—and they are forced to build on, instead of criticize, other participants' ideas.
- The cycle can be repeated multiple times and can be applied to chunks of the problem being addressed, depending on the need.
- The beauty of brainwriting is that it levels the playing field immediately, and it removes many of the obstacles of group brainstorming.
- With traditional verbal brainstorming, the number of ideas which can be expressed at once is limited, and the time it takes to get through a number of ideas is much longer, which results in many participants forgetting or becoming confused while others shout out ideas.
- This is especially so for those who are shy or introverted or who may be at a disadvantage due to being less senior or unfamiliar with the specialisations being discussed.

Brainwriting

- Brainwriting is an excellent starting point for ideation sessions, and can serve as a means to maximise the initial braindump, or as a way to refocus if other ideation methods go haywire.
- Before the chaos of group ideation muddles people's thinking, help them get their initial thoughts out in the open with an introductory brainwriting session and use the results later to build on further with other techniques.

Brainwriting – Best Practice

- If you were the facilitator, you'd brief ideation participants upfront on the problem statement, goals and important user insights from previous research and findings.
- Encourage participants to jot down ideas on their idea cards for 3-5 minutes before passing on their ideas when you make the call.
- Ideally, participants pass on idea cards 3-10 times depending on the problem statement and goals.

Brainwriting – Best Practice

- This all happens silently and without any interference or communication.
- Encourage participants to push themselves for more ideas at least a couple of times, in the few minutes they have, in order to maximize the output and variation.
- You should stoke the session with encouragement and provide questions or statements which push participants to think outside of their comfort zones.
- The cycle can be repeated multiple times and can be applied to chunks of the problem being addressed, depending on the need.
- After ending the cycle, each participant will briefly verbally present the thoughts on the idea card he/she ends up with by the end of the cycle to the rest of the team—in order to spark new streams of thinking or combinations of ideas. If you were the facilitator, you would often be taking notes on a white board.
- When all team members have presented their idea cards, you can select the best ideas which you can continue to build and elaborate on in other ideation sessions. There are various methods you can use such as "Post-it Voting", "Four Categories", "Bingo Selection" and "Now Wow How Matrix".

Brainwriting – Best Practice

There are a lot of different ways to come up with a form that makes sense for the problem you are dealing with but a common procedure is called "brainwriting 6-3-5."

The 6-3-5 stands for 6 people, 3 ideas per person in 5 minutes.

The table on the form is 3 columns wide with plenty of width for writing down the ideas. Number the columns idea 1, idea 2 and idea 3.

Make the table 6 rows down the page for the 6 different people.

When the meeting starts you divide the people up into groups of 6.

Each person takes a sheet and takes 5 minutes to write out 3 ideas in the first row on the form to help solve the problem statement.

Don't put your name on the sheet.

Then you exchange your sheet with someone else.

Either give your sheet to the person on your right or put the six sheets in a pile in the middle of the table and randomly take one from the pile.

Then take the next 5 minutes to add 3 more ideas to the next row on the new sheet.

You can use the ideas that are already on the sheet to stimulate new ideas or create new ideas of your own, whichever works best for you.

After doing this for 30 minutes you will have a total of 108 ideas from each group of 6 people.

Brainwriting

Pros:

One of the main advantages of using 6-3-5 brainwriting is that it is a very straightforward method and therefore is easy and quick to learn. In addition to this, no particular training for the supervisor is required.

Secondly, it valorises the possible different backgrounds of participants since it encourages sharing and exchanging knowledge. Differently than traditional brainstorming, it assures an active participation from all members and at the same time avoids issues of domination over introverts that are also likely to feel more free about expressing their own ideas instead of risking to have their potential inhibited by those who shout louder.

All ideas are recorded on the worksheet, this means that nobody has to be in charge of taking notes throughout the session and this adds a motivational factor since it is possible to keep track of the author of a particular idea.

Overall this leads to a gain of efficiency that might imply an economic benefit since by hiring 6 members 108 possible content ideas are generated.

Brainwriting

Cons:

Expressing ideas in a written form may lead to issues in clarity due to participants having trouble summarising their ideas or reading their colleagues' handwriting or graphical representations.

Stress due to time constraints might cause quality of ideas to decrease, and this might require some people time to become familiar with the methodology.

There is a risk of clash of similar ideas since there is no immediate group discussion which constitutes a loss of possible innovation.

Brainwalking

- Yes, you read it correctly—don't worry, though; it doesn't involve soles touching souls. Brainwalking is very similar to brainwriting with one small but highly impactful difference.
- Instead of passing idea cards or notes from one participant to another, participants have to get up from their seats and move to another spot around the brainstorming table or even to another table altogether.
- Bryan Mattimore came up with this technique; he's a specialist in the art of ideation and facilitation.
- Mattimore has many years and thousands of sessions of experience conducting ideation sessions.
- In his book Idea Stormers, he describes brainwalking as the: 'single best technique to use to begin an ideation session'.
- Brainwalking gets people out of their seats, gets them moving, keeps energy levels up and mixes things up enough so that the group as a whole does not get stuck delving too long down the same one-way street, without a quick exit or U turn available. Brainstorming works best when it is easy to flip or to start from scratch.

Concepts in Engineering Design

Reverse Brainstorming

Reference: https://www.teachengineering.org/activities/view/cub_creative_activity3

Reversed Brainstorming

In order to reach creative output, the process itself needs to be creative and innovative.

However, the above-mentioned brainstorming process lacks the creativity that can help to obtain the desired results out of the meeting session.

Reverse brainstorming tries to solve the problem in a reversed way to the flow we already now.

The method can influence the human mind to create better ideas and solutions.

Instead of asking how to solve the problem, reverse brainstorming focuses on the idea of what causes the problem or how to achieve an opposite result of what is expected.

This method helps the team to understand the problem and highlight the ideas that can be used to solve it among other ideas discussed during the meeting.

For example, the team thinks how to increase the cost instead of how to reduce it…etc.

Reference:accounts.google.com/AddSession/signinchooser?hl=en&continue=https%3A%2F%2Fmail.google.com%2Fmail&service=mail&flowName=GlifWebSignIn&flowEntry=AddSession

Objectives of Reversed Brainstorming

Reverse brainstorming provides unusual thinking methods to reach solutions that ordinary thinking methods do not achieve. As creative thinking requires a special flow of ideas, reverse brainstorming can help teams to create using unique thinking methods. Reverse brainstorming can be applied directly during the discussion meeting or it can be used if ordinary brainstorming fails to reach the desired solution for the problem or the targeted creative approach.

Steps in applying Reversed Brainstorming

Reverse brainstorming session works in a way to achieve the target through five main steps. The team goes through each step and discusses it as a group. These steps include the following:

Step 1: Clearly identify the problem that needs to be solved by the end of the group meeting

Step 2: Reverse the expected process. For example ask the stakeholders questions such as “how can we make the problem worse?” instead of “How can we solve it?”

Step 3: Collect all the reversed solutions. All the ideas are acceptable without no criticism

Step 4: After reaching the cases that make the problem worse, flip these cases to reach the best fixes for the problem.

Step 5: Judge and evaluates the results to reach one best solution.

The above steps start and end in a similar matter to the ordinary brainstorming process. However, the inner steps are reversed to reach the best solution through understanding the worse cases. These steps are discussed during the stakeholder meeting using simple tools such as a whiteboard, erasable markers with different colors and sticky notes.

Example: Reversed Brainstorming

One of the practice examples of applying reversed brainstorming could be a design company that is working on improving the website design for a specific client. The problem. Is that website visitors do not stay in the website for enough time or interact with the website content as expected. Based on this scenario, the reversed brainstorming session flows as follows:

The first step is to identify the problem needed to be solved. The website users do not engage or interact with the website content as expected.

In the second step, the team flips the problem. For example. The team asks a question about how to drive the users away from the website and reduce the interaction level.

In the third step, the team thinks of the methods that can drive the user away from the website rather than visiting and interacting with it. For example, the team manager asked the designers to think in methods to drive the user away from the website.

Steps in applying Reversed Brainstorming

The reverse brainstorming discussion requires whiteboard, erasable markers and sticky notes.

Example: Reversed Brainstorming

The answers can be as following:

- Build complex navigation so users cannot find desired content
- Choose a disturbing color theme and hard to read fonts
- Host the website on a slow server
- Use large files that are hard to load

After building an Idea about the methods that can drive the user away from the website, the fourth step reverses all these methods to reach the possible solutions for the problem such as:

- Build an easy navigation and clear website structure
- Choose comfortable color theme and easy to read fonts
- Choose a reliable hosting service that ensures speed website loading
- Optimize the website content so users can view it properly

The fifth step determine which of these methods are not applicable to the website and how to apply the needed methods in order to solve the user interaction problem.