

Creativity Through Limited Resources: A Film Analysis of Simple Technology in Spare Parts (2015)

Tsamrotul Hidayah^{1*}, M. Thoyibi¹

¹*Universitas Muhammadiyah Surakarta, Indonesia*

a320210163@student.ums.ac.id*

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Abstract

The urgency of this research lies in the need for inclusive STEM education in under-resourced settings, demonstrating that low-cost technology can effectively foster innovation and active learning. The purpose of this study is to analyze the representation of the use of simple and low-cost technology in the context of education in the film *Spare Parts (2015)*, as well as to examine how the characters in it demonstrate creativity, collaboration, and innovation in facing resource constraints, in order to identify educational values related to STEM empowerment conveyed through the film's narrative. This research employs a qualitative descriptive method to analyze the representation of low-cost technology and STEM empowerment in the film *Spare Parts (2015)*. The object of the study is the film directed by Sean McNamara, with scenes, dialogues, character actions, and visual elements as the primary data. Data collection was conducted through repeated film viewing, documentation of relevant scenes, and literature review of scholarly sources related to STEM education, educational technology, and film studies. Data analysis involved identifying, categorizing, and interpreting film elements based on the theoretical framework. To ensure data validity, theory triangulation was applied by integrating the Philosophy of Technology, STEM Empowerment Theory, and Sociocultural Learning Theory. This study concludes that *Spare Parts (2015)* portrays low-cost technology, creativity, and STEM learning as interconnected processes shaped by limited resources. The film shows that resource constraints can stimulate innovation through improvisation, trial and error, and collaborative problem-solving, where students transform simple materials into functional technology. By emphasizing student agency, mentorship, and teamwork, the film represents STEM empowerment as a holistic learning process that fosters confidence, creativity, and meaningful educational experiences in resource-limited contexts. The findings suggest that film-based narratives like *Spare Parts* can be used as pedagogical tools to inspire creativity, collaboration, and problem-solving while promoting affordable STEM learning approaches.

Keywords: Creativity, Resource-Limited Environment, Film Analysis

Introduction

21st-century education emphasizes not only the transmission of theoretical knowledge but also the development of essential skills such as creativity, critical thinking, collaboration, and problem-solving, particularly in learning environments characterized by limited resources (Arjas & Ahmad, 2025). These competencies are central to the 21st-Century Skills framework, which highlights the need for learners to adapt to rapid technological, social, and economic changes in a globalized society (Ouyang & Xu, 2024). Within this framework, learning is expected to be student-centered, experiential, and problem-based, enabling students to actively construct knowledge through real-world challenges.

In this context, the film *Spare Parts* (2015), based on a true story, presents a compelling case for academic analysis. The film portrays a group of high school students from an underfunded school who successfully design and build an underwater robot using recycled and low-cost materials to compete in a national robotics competition. Through its narrative, the film illustrates how constraints such as limited funding and restricted access to advanced technology do not hinder learning, but instead encourage innovation, creativity, and collaborative problem-solving (Psalidou et al., 2025). The students' reliance on simple technology and improvisation demonstrates an alternative model of STEM education in which creativity and resourcefulness play a crucial role (Abdiyah & Subiyantoro, 2021).

Furthermore, *Spare Parts* highlights the role of mentorship, teamwork, and student agency in fostering meaningful learning experiences. By depicting students as active learners who apply scientific and engineering concepts in practical contexts, the film reflects key principles of constructivist and sociocultural learning theories, where knowledge is developed through interaction, experimentation, and shared problem-solving (Ouyang & Xu, 2024). Therefore, the film serves as a relevant cultural text for examining how creativity, simple technology, and STEM empowerment can emerge effectively within resource-limited educational settings. Temuan ini menegaskan bahwa keterbatasan sumber daya tidak selalu menjadi hambatan, melainkan dapat mendorong kreativitas, eksperimen, dan pembelajaran aktif.

In line with these findings, previous studies have shown that English language learning in resource-limited contexts faces various challenges, such as limited facilities, low access to technology, and a lack of learning media (Azhar, 2025). To overcome these conditions, researchers emphasize the importance of creative and adaptive strategies, such as the use of simple media, collaborative learning, and the use of affordable technology to increase student engagement (Suryanto, 2025). Other studies also highlight that the integration of narratives and media, including videos and storytelling, can increase student motivation, empathy, and understanding in English language learning (Puspitasari et al., 2025). In general, these studies conclude that innovative and student-centered approaches can improve the effectiveness of language learning, even with limited resources.

Although various studies have discussed the challenges and strategies in English language learning and the use of simple media and technology, there are still few studies that specifically analyze film as a pedagogical representation of the use of low-cost technology and learner empowerment through educational narratives. Previous studies have generally focused on real classroom practices or general instructional strategies, without examining how the values of creativity, collaboration, and innovation are represented narratively through film media.

Therefore, this study offers novelty by analyzing the film *Spare Parts* (2015) as an educational text that represents resource-constrained learning, where simple technology becomes a means of empowering students. This study expands the study of media-based English learning by showing how films can function as pedagogical tools to instill the values of active, inclusive, and innovative learning in the context of resource-limited education.

These findings are theoretically aligned with constructivist learning theory, which posits that learners actively construct knowledge through hands-on experiences, experimentation, and problem-solving rather than passive reception of information (Choudhary & Potdar, 2023). Educational robotics provides a tangible learning environment where students engage directly with abstract STEM concepts by designing, building, and testing technological artifacts. In addition, constructionism, as proposed, further explains the effectiveness of robotics in education by emphasizing learning through making meaningful products. When students create robotic systems, they externalize their thinking processes, reflect on errors, and refine solutions through iterative design.

Furthermore, from a sociocultural learning perspective, robotics-based learning encourages collaboration, dialogue, and shared problem-solving, allowing knowledge to be co-constructed through social interaction (Vygotsky, 1978). This theoretical framework supports the idea that even simple and low-cost technological tools can become powerful mediators of learning when embedded in collaborative and inquiry-based instructional contexts. Therefore, educational robotics not only enhances cognitive outcomes in STEM learning but also fosters creativity, motivation, and learner agency, particularly in resource-limited educational environments.

Project-based learning and maker-based pedagogy also contribute significantly to strengthening students' engagement, creativity, and ability to think critically and solve problems (Daodu et al., 2024). In robotics and other simple technology projects, students are not merely passive consumers of knowledge but become active agents in learning designing, creating, testing, and revising their own work (Syahrir et al., 2024). Thus, *Spare Parts* may be interpreted as a visual representation of these pedagogical principles of collaborative learning, experimentation, improvisation, and creativity.

From a film and visual literature perspective, *Spare Parts* is not only entertainment but also a text rich in social, educational, and cultural meaning. Through analysis of symbolism, dialogue, conflict, and characterization, researchers can explore how the film portrays realities in education such as economic struggles, unequal access to learning facilities, and the experiences of immigrant students while also showcasing learning and empowerment processes. This approach is relevant in English Education programs, as films can be used as audiovisual literature containing linguistic value, narrative structure, and socio-cultural context.

In Indonesia and many other developing countries, schools still face major challenges related to funding, access to technology, and availability of facilities. Therefore, learning models based on simple technology and student creativity are highly relevant and contextual. By analyzing *Spare Parts*, this research can illustrate how informal education and minimal resources can still lead to significant achievements through creativity and collaboration offering inspiration for educational policies and classroom practices in resource-limited contexts.

The reason for choosing the title “Creativity Through Limited Resources: A Film Analysis of Simple Technology in *Spare Parts* (2015)” is to explore how the film portrays innovation and problem-solving in an educational environment with limited facilities. *Spare Parts* (2015) presents a real story of students who successfully build an underwater robot using low-cost components, showing that creativity and collaboration can flourish despite economic and technological constraints. This topic is relevant to 21st-century learning concepts, which emphasize creativity, critical thinking, teamwork, and adaptability as key skills for students in a rapidly changing world.

Additionally, this study contributes academically by combining film analysis with educational perspectives, specifically related to STEM empowerment through simple and accessible technology. Many schools, particularly in developing countries, face limited resources, making the message of the film highly contextual and meaningful. Since previous studies have rarely examined *Spare Parts* (2015) as a representation of low-cost technology education, this research is expected to provide new insights into how film can reflect and inspire innovative learning practices through creativity and the effective use of minimal resources.

The purpose of this study is to analyze the representation of the use of simple and low-cost technology in the context of education in the film *Spare Parts* (2015), as well as to examine how the characters in it demonstrate creativity, collaboration, and innovation in facing resource constraints, in order to identify educational values related to STEM empowerment conveyed through the film's narrative.

Method

This research is a qualitative descriptive study, which aims to describe and analyze phenomena naturally based on existing data. In this study, the approach is used to analyze how the film represents low-cost technology and STEM empowerment through its narrative, characters, and visual elements. Therefore, qualitative descriptive research is appropriate for exploring educational and socio-cultural messages embedded in the film.

The object of this study consists of the material object and the formal object. The material object of this research is the film *Spare Parts* (2015) directed by Sean McNamara, which tells the story of four undocumented high school students who build a low-cost underwater robot to participate in a national competition. This film serves as the primary source from which data in the form of scenes, dialogues, and character actions are collected and analyzed. The formal object focuses on the representation of low-cost technology and STEM empowerment reflected in the film. The analysis emphasizes how the narrative and cinematic elements illustrate innovation in limited-resource environments, student motivation, and the role of education in shaping empowerment. Through this perspective, the study seeks to reveal how the film conveys values of creativity, inclusion, and socio-educational transformation.

The data in this study consists of two types of data. First, primary data, in the form of relevant elements from the *Spare Parts* (2015) film, including dialogues, scenes, character actions, visual elements, and narrative events that portray low-cost technology, STEM empowerment, teamwork, and social struggles. These elements are analyzed to describe how the film represents empowerment through technology in a resource-limited educational context. Second, secondary data consists of theoretical references, scholarly articles, expert reviews, and

studies related to film analysis, STEM education, robotics learning, and low-cost innovation. This data is used to support and strengthen the interpretation of the primary data.

There are also two data sources in this study. (1) The primary data source is the film *Spare Parts* (2015) directed by Sean McNamara, which serves as the main object of analysis. (2) The secondary data sources come from scientific literature such as e-books, e-journals, conference papers, and theoretical publications discussing STEM learning, educational technology, and film as a medium of educational representation. These sources provide a conceptual foundation and comprehensive insights relevant to the research focus.

The technique of data collection and data analysis in this study was conducted through several systematic stages. First, the researcher watched the film *Spare Parts* repeatedly to gain an in-depth understanding of the storyline, character development, and the educational elements presented. During this process, important scenes related to the use of low-cost technology, teamwork, and STEM empowerment were identified and documented through screenshots. In addition, the researcher collected supporting data by reading books and scientific articles relevant to the philosophy of technology, STEM learning, and educational empowerment. The main ideas derived from both the film and the literature were then carefully noted and organized according to the theoretical framework of the study. Furthermore, specific scenes, dialogues, monologues, and character actions that reflected values of STEM empowerment and low-cost innovation were identified as the primary data. These data were subsequently connected with the theoretical references to identify patterns, meanings, and relationships relevant to the research focus. Finally, the data were interpreted by analyzing how philosophical and educational perspectives were represented in the film, which allowed the researcher to construct broader and more comprehensive conclusions.

Triangulation is a method used to ensure the validity and credibility of data by combining multiple sources or analytical perspectives (Sugiyono, 2018). In this study, theory triangulation is applied by integrating several theoretical frameworks namely Philosophy of Technology, STEM Empowerment Theory, and Sociocultural Learning Theory to analyze the film. This approach helps strengthen the research findings and avoid subjective interpretation in analyzing the elements presented in the *Spare Parts* film.

Results and Discussion

Result

Representation of Simple and Low-Cost Technology

In the context of low-resource educational environments, simple and low-cost technology refers to the utilization of affordable, easily accessible, and recycled materials to solve technical problems. Rather than relying on advanced or expensive equipment, learners are encouraged to creatively adapt everyday objects to meet functional needs. This approach highlights innovation, problem-solving skills, and practical understanding of STEM concepts within limited facilities. The representation of simple technology in *Spare Parts* (2015) is clearly portrayed in several scenes where the students discuss and experiment with inexpensive materials for constructing their underwater robot.



Figure 1. Scene 00:17:40,724

In this scene, Dr. Cameron explains the fundamental principle of engineering by emphasizing the importance of creating a proof-of-concept model before using real or expensive materials. His statement highlights an educational approach that prioritizes experimentation and learning through simplified models. Responding to this guidance, Cristian proposes using hangers as the structural frame of the robot, while Oscar suggests styrofoam as ballast to maintain balance. This interaction illustrates how abstract engineering principles are translated into practical problem-solving through the use of low-cost and readily available materials.

Dr. Cameron : The first rule of engineering is you never build anything with real material, until you build a proof-of-concept model

Cristian : We can use hangers for the frame.

Oscar : Styrofoam for ballast?

(Script on Scene 00:17:40,724-00:17:52,663)



Figure 2. Scene 00:19:30,001

In this scene, Aleta and Oscar examine old toy cars with chipped paint, indicating that the objects are no longer visually appealing or considered new. However, Aleta points out that despite their worn appearance, the toys are still functional. Oscar then states that he only needs the motors inside the toy cars, suggesting a selective use of components based on functionality rather than form. This scene emphasizes a problem-solving mindset that values utility and resourcefulness over aesthetic condition, reflecting an engineering-oriented perspective on material reuse.

Aleta : The paint's chipped, but they still work.

Oscar : I just need the motors inside.

(*Script on Scene 00:19:30,001-00:19:33,869*)



Figure 3. Scene 00:36:25,882

In this scene, Christian enthusiastically introduces waterproof electric motors that are specifically designed for underwater robotics. He describes the motors as spectacular, emphasizing their advanced functionality and technical advantages. However, Oscar immediately points out the price of the motors, stating that although they are small and powerful, they cost \$299.99, a price far beyond the students' financial capacity. This contrast highlights the tension between technological sophistication and economic constraints, underscoring the need for cost-effective alternatives in educational engineering projects.

Christian : Waterproof electric motors. Aren't they spectacular?

Oscar : They're small, they're powerful, they're \$299.99.

(*Script on Scene 00:36:25,882-00:36:32,007*)



Figure 4. Scene 00:36:39,030

In this scene, Christian firmly rejects the idea of giving up after realizing that advanced waterproof motors are financially inaccessible. His statement reflects persistence and determination in facing technical obstacles. Lorenzo then proposes an alternative solution by suggesting the use of multiple small motors clustered together to replicate the function of a single

expensive motor. This exchange illustrates collaborative problem-solving and adaptive engineering, where creativity and perseverance are used to overcome financial and technical limitations.

Christian : No! We're not giving up.

Lorenzo : Wait a minute. What if we get a bunch of tiny motors and just hook 'em up together and cluster them together?

(Script on Scene 00:36:39,030-00:36:47,059)



Figure 5. Scene 00:42:59,043

This scene illustrates how the students rely on observation, technical knowledge, and creativity to recognize the potential function of discarded materials. Video said something about retrieving a liquid. In particular, their discussion about retrieving a liquid highlights how these materials are repurposed to solve a specific engineering challenge rather than being viewed as waste.

Creativity and Innovation through Limited Resources

After presenting the representation of simple and low-cost technology, the analysis moves toward examining how limitations in resources stimulate creativity and innovation among the students. In *Spare Parts* (2015), the lack of advanced equipment and financial support does not function merely as an obstacle, but becomes a catalyst for creative problem-solving and adaptive thinking. The students are repeatedly shown transforming constraints into opportunities by reimagining available materials, developing alternative strategies, and collaboratively experimenting with unconventional solutions. This section focuses on how creativity and innovation emerge through processes of improvisation, trial and error, and collective reasoning within a resource-limited engineering context.



Figure 6. Scene 00:24:50,489

In this scene, Lorenzo explains the technical requirements needed to control the robot's movement and speed. He describes the necessity of adding another switch to control vertical motion and suggests using a joystick to manage speed control. Christian responds by acknowledging the additional components involved in implementing the system. The discussion takes place collaboratively, with each character contributing technical input based on their understanding. This interaction demonstrates collective technical reasoning, where system design emerges through shared knowledge and cooperative problem-solving.

Lorenzo : If you want up down, you've gotta get another switch.

Lorenzo : If you wanna control speed, I'd spring for a joystick

Christian : You know, and all the stuff that comes with it.

Dr. Cameron : Lorenzo, this is really great work.

(Script on Scene 00:24:50,489-00:25:05,934).



Figure 7. Scene 00:43:21,565

In this scene, Oscar explains that laser-based measurements would require adjustment due to the index of refraction of water. Lorenzo follows by stating the scientific value of the index of refraction, which is 1.33, demonstrating an understanding of physics concepts related to light behavior in water. Christian then acknowledges that, under their current circumstances, the use of such advanced measurement techniques is not feasible. In response, Dr. Cameron decides to

shift the approach by instructing the team to use analog methods instead. This shift underscores the importance of adaptability in engineering practice, where methodological choices are shaped by contextual constraints rather than theoretical precision alone.

Oscar : Well, any laser measurement would have to be adjusted

Lorenzo : by the index of refraction of water, which is 1.33.

Christian : Although, right now that seems a little moot.

Dr. Cameron : All right. We'll go analog.

(Script on Scene 00:43:21,565-00:43:35,443)



Figure 8. Scene 00:52:25,675

In this scene, Oscar praises the decision to place the “brain” of the robot, referring to its control system, on a separate unit known as Stinky. Cristian explains that the new design ensures the control system is no longer submerged in water by placing it inside a protective casing. Luis then emphasizes the significance of this decision by pointing to the secured location of the robot’s “brain.”

Oscar : Putting the brain on Stinky was genius.

Cristian : Our brain isn't in the water in that new case,

Luis : Our brain is right here!

(Script on Scene 00:52:25,675-00:52:33,114)

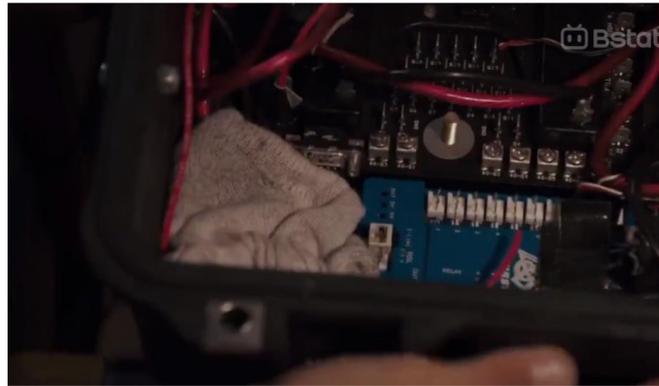


Figure 9. Scene 01:14:11,145

In this scene, Christian expresses concern by asking how the team can fix a technical problem that has occurred. Instead of immediately repairing the issue through conventional methods, Oscar questions the assumption that the problem must be fixed in the usual way. Lorenzo then proposes an improvised solution by asking Luis to give him his sock, suggesting the use of a personal item as part of the technical workaround. This interaction illustrates unconventional problem-solving, where creativity and improvisation enable the team to overcome technical challenges despite limited resources.

Christian : How do we fix it?

Oscar : Wait. Who says we gotta fix it?

Lorenzo : Luis, give me your sock.

(Script on Scene 01:14:11,145-01:14:18,641)

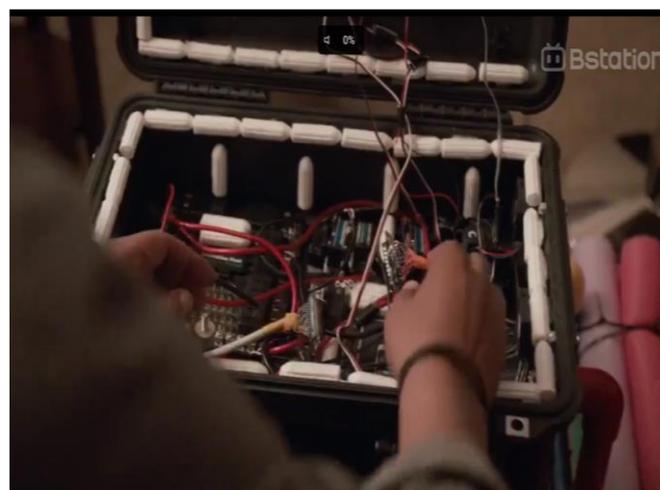


Figure 10. Scene 01:16:24,445

In this scene, Lorenzo explains that a particular material was recommended because it does not require applicators, suggesting an attempt to simplify the construction process. Christian seeks clarification, indicating an ongoing exchange of understanding within the group. Oscar then urgently calls the others' attention to an issue, prompting Dr. Cameron to invite the team to

observe the result. Lorenzo reacts by expressing surprise, stating that the method had worked perfectly before. This moment highlights the experimental nature of the engineering process, where unexpected outcomes prompt reflection, discussion, and collective learning.

Lorenzo : Yeah, the lady said these were best for us 'cause they don't got applicators.

Christian : What does that mean?

Oscar : Damn. Guys, guys!

Dr. Cameron : Come and take a look at this.

Lorenzo : Come on. That was perfect when I did it.

(Script on Scene 01:16:24,445-01:16:44,298)

STEM Empowerment and Collaborative Learning

Following the discussion on creativity and innovation through limited resources, the analysis proceeds to examine the role of STEM empowerment and collaborative learning in shaping the students' learning experiences. In *Spare Parts (2015)* STEM education is portrayed not only as the acquisition of technical skills, but also as a process of empowerment that builds students' confidence, agency, and sense of responsibility through hands-on problem-solving. At the same time, learning is depicted as a collaborative effort in which knowledge is constructed through discussion, shared decision-making, and mutual support among team members. This section focuses on how STEM empowerment and collaborative learning are represented through teamwork, mentorship, and collective engagement in overcoming technical and social challenges within a constrained educational environment.



Figure 11. Scene 00:24:03,508

In this scene, Dr. Cameron introduces Lorenzo as the team's new mechanic. Oscar immediately rejects the idea, expressing doubt about Lorenzo's suitability for the group. Lorenzo responds by preparing to leave, indicating his initial exclusion from the team. Dr. Cameron intervenes by asking Lorenzo to stay and sit down, asserting his authority as a mentor. Christian then labels Lorenzo as a "weak link," to which Dr. Cameron responds by reframing Lorenzo's role as the team's "linchpin," emphasizing his importance to the group's success. This exchange

highlights the mentor's role in reshaping group dynamics by challenging negative labeling and reinforcing each member's value within the collaborative learning process.

Dr. Cameron : This is our new mechanic, Lorenzo.

Oscar : No. Not gonna happen. Cannot have him on the team, sir.

Lorenzo : All right, cool. See you guys.

Dr. Cameron : Hey, come on. Sit down. All right?

Christian : You don't know this kid, sir. He's a weak link.

Dr. Cameron : Well, actually, I do kinda know the kid. He's your linchpin.

Dr. Cameron : Which means we're not gonna have any attitude, right, linchpin?

(Script on Scene 00:23:43,221-00:24:08,035)



Figure 12. Scene 00:25:09,740

In this scene, Oscar cautiously acknowledges Lorenzo's technical performance, implying conditional acceptance within the team. Lorenzo immediately rejects being treated as a subordinate, asserting his dignity and autonomy. Christian points out his presence in the discussion, signaling sensitivity to group dynamics. Oscar then shifts his approach by inviting Lorenzo to actively participate in the planning process and contribute to the team's timeline. Dr. Cameron concludes the interaction by affirming the positive development of team spirit. This scene illustrates a transition from tension to inclusion, where mutual respect and shared responsibility strengthen collaboration within the team.

Oscar : I guess if we can get him to perform like this regularly...

Lorenzo : Hey, I'm not your house cat.

Christian : I'm sitting right here.

Oscar : Did you want to be part of the planning process?

Oscar : Do you really want to help us work out our timeline?

Dr. Cameron : Okay, great team spirit. Okay.

(Script on Scene 0:25:09,740-0:25:21,244)



Figure 13. Scene 00:46:40,998

In this scene, Dr. Cameron identifies a technical issue related to efficiency not reaching its full potential. Lorenzo explains that the loss of power occurs due to degradation along the length of the tethers. Oscar suggests shortening the tethers, but Lorenzo rejects the idea, explaining that sufficient length is necessary to maneuver around the course. Christian then proposes using better cable, assuming it may be affordable. Dr. Cameron dismisses the suggestion by emphasizing the limitations of cable quality. As the discussion becomes tense, Lorenzo challenges others to think of alternative solutions, prompting frustration among the team. Oscar reacts defensively, leading Dr. Cameron to intervene and remind the students not to turn on each other and to remain calm. This moment reveals how technical constraints can intensify interpersonal tension, underscoring the mentor's role in maintaining focus, emotional regulation, and collaborative problem-solving under pressure.

Dr. Cameron : It's the efficiency not reaching its full potential.

Lorenzo : The power's degrading over the length of the tethers.

Oscar : We could make the tethers shorter. -Can't.

Lorenzo : We need the length to maneuver around the course.

Christian : All right, then we get better cable. I mean, how much could it be?

Dr. Cameron : Cable is cable. Even I know that.

Lorenzo : Well, then why don't you think of something then?

Oscar : Why does it have to be on me? -Don't turn on each other, okay?

Dr. Cameron : Don't turn on each other. Nobody's expecting any miracles. Relax.

(Script on Scene 00:46:40,998-0:46:59,947)



Figure 14. Scene 01:16:56,444

In this scene, Lorenzo explains that repairing the component took him five hours previously and points out that it is already late, implying physical exhaustion and time limitations. Dr. Cameron acknowledges the risk involved, noting that a small mistake could damage the entire connector and render the robot inoperable. Lorenzo emphasizes the severity of the situation by stating that “Stinky” would be unusable if the repair failed. Dr. Cameron responds by asserting that inaction would lead to the same outcome. Oscar then encourages Lorenzo by stating that their chances of success would significantly improve with his help. The scene concludes with Lorenzo agreeing to assist, signaling his commitment to the team. This moment highlights the convergence of technical risk, personal sacrifice, and collective responsibility, marking a turning point in Lorenzo’s full integration into the team.

Lorenzo : Hey, it took me five hours the first time.

Oscar : So?

Lorenzo : So, it's late.

Dr. Cameron : You know, if I nod off and nick one pin, the whole connector would be shot.

Lorenzo : I mean, Stinky'd be dead.

Dr. Cameron : Stinky's as good as dead if you don't do anything.

Oscar : Our chances are a lot better if you help.

Lorenzo : Right there.

(Script on Scene 01:16:56,444-01:17:21,367)



Figure 15. Scene 01:23:30,904

In this scene, Christian recalls his earlier assumption that participating in a particular division would be less embarrassing for the team, implicitly acknowledging that the decision may not have been ideal. Dr. Cameron listens without assigning blame. Christian then suggests that his judgment should not be followed next time, reflecting self-awareness and humility. Dr. Cameron responds by redirecting the team's attention toward the present task, encouraging them to stay focused and work together. This exchange underscores a learning-oriented team culture in which mistakes are acknowledged constructively and leadership emphasizes collective progress over individual fault.

Christian : Do you remember when I said that this division would be less embarrassing for us?

Dr. Cameron : Yeah.

Christian : Yeah, maybe next time, you shouldn't listen to me.

Dr. Cameron : Okay, guy, come on! Stay focused and work together, okay?

(Script on Scene 01:23:30,904-01:23:36,841)



Figure 16. Scene 01:27:42,890

In this scene, a judge announces that the team has scored 30 points while still having half of the course remaining. This statement functions as formal performance feedback, indicating that the team is progressing but has not yet completed the challenge. Oscar immediately responds by reframing the information positively, referring to the situation as “halftime” and encouraging the

team to finish strong. This response demonstrates motivational leadership, as Oscar transforms evaluative feedback into a source of momentum and collective confidence.

Judge : That's 30, with half of the course still to go.

Oscar : You hear that?. It's halftime, boys. Let's finish strong.

(*Script on Scene 01:27:42,890-01:27:49,229*)

Discussion

The findings from the analysis of *Spare Parts* (2015) confirm and expand existing research on STEM education by illustrating how limited resources can act as catalysts for creativity, collaborative problem-solving, and learner empowerment. Rather than depicting resource scarcity as an insurmountable barrier, the film aligns with contemporary studies that show how lack of material wealth often stimulates innovative thinking and meaningful engagement in STEM activities. This section compares the findings with existing empirical and theoretical research to situate the study within the broader educational literature.

The representation of simple and low-cost technology in *Spare Parts* echoes the emphasis in recent educational research on the value of contextually grounded STEM tasks that promote creative thinking. Komalasari et al (2024) demonstrated that STEM learning, when coupled with a scientific approach, significantly improves students' creative and critical thinking outcomes by engaging them in experimental and problem-based tasks; the students are required to explore alternatives and justify decisions based on observable outcomes. This aligns with the ways in which the characters in *Spare Parts* improvise solutions such as repurposing toy motors or combining inexpensive materials instead of relying on advanced tools, reinforcing that creativity can emerge from necessity rather than abundance.

Similarly, Ramadhani and Hardianti (2025)) systematic review of STEM approaches emphasizes that creative thinking is not only a cognitive skill but also a social process facilitated through authentic projects that integrate science and engineering principles. Their findings suggest that when learners are faced with real-world challenges, such as designing functional prototypes within constraints, they develop adaptive strategies and divergent thinking. This theoretical lens supports the film's portrayal of students navigating engineering problems with limited resources, validating that creativity in STEM is best nurtured through grounded, collaborative tasks rather than idealized laboratory conditions.

The scenes in *Spare Parts* portraying group discussion, negotiation, and shared decision-making are consistent with findings from empirical research on collaborative STEM learning. Nikmah et al (2024) found that using STEM-collaborative learning materials enhances critical thinking and engagement by requiring students to articulate reasoning, listen to peers, and adjust ideas collectively. In the film, students defend their technical suggestions, reach compromises, and manage interpersonal tensions, reflecting the developmental processes described in the literature. These interactions illustrate how students construct understanding collaboratively rather than in isolation, reinforcing Nikmah et al.'s conclusion that collaboration is a core mechanism for deep cognitive engagement in STEM contexts.

In addition, Syahrir et al (2024) highlight that integration of technology in STEM learning expands opportunities for interactive problem solving and coordination among students. While

Spare Parts focuses on physical materials rather than digital tools, the underlying dynamics of coordination, shared responsibility, and interaction are parallel to Syahrir and colleagues' findings. The film's depiction of team roles, mentor guidance, and mutual support emphasizes that collaborative learning is as much about social and communicative processes as it is about technical execution. Thus, the film supports research asserting that STEM education should extend beyond individual competence toward collective meaning-making and shared knowledge construction.

A significant contribution of *Spare Parts* to educational discourse is its vivid illustration of learner empowerment, a concept reinforced by research on learner autonomy and agency in STEM. Azizah and Angelina (2025) found that STEM-based learning environments significantly improve student creativity and self-efficacy compared to traditional methods, particularly when students are encouraged to make decisions, reflect on outcomes, and iterate designs. This resonates with the film, where students make autonomous technical choices, learn from errors, and refine their approaches without being overly directed by instructors. Dr. Cameron's role as a facilitator, rather than an authoritarian figure, mirrors modern pedagogical models that advocate coaching over lecturing and support students' self-directed exploration. Contemporary STEM education research posits that empowerment involves learners' belief in their capability to act effectively within a domain (Arocena et al., 2022). The students in *Spare Parts* demonstrate this belief through persistence in solving engineering challenges, adapting to setbacks, and taking ownership of project outcomes. This narrative reinforces the literature suggesting that empowerment is cultivated not through the removal of challenges, but through sustained engagement with tasks that require resilience and collective problem-solving.

Overall, the comparison between *Spare Parts* and current research shows that the film's portrayal of STEM learning dynamics is not only realistic but closely aligned with evidence-based pedagogical practices. The combination of creativity, collaboration, empowerment, and resilience in the face of constraints reflects the characteristics of effective STEM education identified across the literature. This comparison validates the film's instructional value as a cultural text that resonates with contemporary educational priorities, particularly those emphasizing project-based learning, constructivist approaches, and learner agency. In conclusion, the film illustrates that limited resources far from diminishing learning quality can provide a fertile context for stimulating high-order thinking, social interaction, and learner growth. The comparison with previous research confirms that the themes in *Spare Parts* are supported by current empirical evidence, reinforcing that effective STEM education is an integrative process grounded in authentic problem solving, collaboration, and empowerment.

Conclusion

This study concludes that *Spare Parts* (2015) represents technology, creativity, and learning as interconnected processes shaped by limited resources. The film demonstrates that simple and low-cost technology can function effectively as a medium for STEM learning when combined with creativity, collaboration, and student agency. Rather than portraying resource limitations as obstacles, the film presents them as conditions that stimulate innovative thinking, adaptive problem-solving, and hands-on experimentation.

The findings reveal that creativity and innovation emerge through processes of improvisation, trial and error, and the reconfiguration of everyday materials. Students are shown transforming discarded or inexpensive objects into functional technological components, highlighting that innovation in engineering does not depend solely on access to advanced tools, but on the ability to think flexibly and collaboratively. This reinforces the idea that constrained environments can foster meaningful learning experiences.

Furthermore, the film emphasizes STEM empowerment by portraying students as active agents who apply scientific and engineering concepts, make decisions, and take responsibility for outcomes. Through mentorship and supportive guidance, students develop confidence, persistence, and a sense of ownership over their learning process. Collaborative learning is also strongly represented, as knowledge is constructed through dialogue, shared planning, conflict management, and collective problem-solving. Overall, *Spare Parts* illustrates that effective STEM learning is holistic, integrating simple technology, creativity, empowerment, and collaboration within a resource-limited context.

This study can serve as a reference for future researchers interested in examining films that depict the intersection of technology, education, and creativity in resource-limited contexts. However, this study is limited by its focus on a single film and the use of qualitative interpretation, which may restrict the generalizability of the findings and reflect narrative representations rather than real classroom practices.

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