

Comparison of Key Challenges Facing Non-formal Educational Organizations

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Introduction

The main goal of the paper is to compare and evaluate the key challenges facing Techmania Science Center in Pilsen, Czech Republic and Discovery World Milwaukee, WI USA. The project team from Marquette University and the University of West Bohemia will analyze these two similar non-profit educational institutions – Techmania Science Center and Discovery World. The first section of the paper will outline the history, mission, and purpose for each organization. The second section will focus on the key challenges facing Techmania and Discovery World. Finally, an analysis of potential solutions will be presented.

1.1 History, Mission and Purpose

1.1.1 Techmania Science Center

Techmania is a technical museum established in 2005 by the Škoda Company and the University of West Bohemia. Techmania was built on the Škoda Industrial Estate in the heart of Pilsen. Techmania was opened for the public in 2008. The intention of both founders was to respond to the present decreasing interest in science, technology and engineering among young people in the Czech Republic. Czech Republic, especially Pilsen is well known because of the mechanical industry. The aim of science centers is to increase the interest in science and technology. The main target groups are children and youth. Techmania promotes non-formal education based on exhibits that explain a particular mathematical or physical principle by means of game-like activities. The interactivity involves visitors making the exhibits move and react, so the particular process will demonstrate the natural principle. In these cases, learning is based on personal experience. Techmania's mission and purpose is to help the public become more familiar with the development of human knowledge, as well as show how human knowledge is used in technology. The most important outcome is to assist the next generation to solve unanswered questions in science and technology (Techmania Science Center, 2014).

Nowadays Techmania Science Center divided into two parts which are in two buildings. In one there is Techmania itself and in the other building which is next to it, there is Planetarium. The Planetarium was opened in November 2013.

Techmania itself consists of Science Center and Planetarium.

Picture 1: New area of Techmania Science Center



Source: Techmania Science Center (2014)

Science Center

Compared to former exhibition space Techmania expanded from 3000 m² in late 2008 to 10 000m² now. Currently are these exhibits on display:

- Human and Animal: Discover yourself and compare it with the animal world. How much water is in the body of a jellyfish? Are you faster than a hen? Is your grip as strong as Hyena's? And on many other questions visitors can find answer in this section.
- Edutorium: Physics is fun! Sixty interactive exhibits prove that the laws of nature determine our whole world. So why not recognize them? Visitors can play with optics, discover the principles of electricity and test the laws of mechanics.
- Entropa: A work of art that moved Europe. This sculpture offers controversial views on the European nations.
- Renewable energy sources: Water, wind, sun, earth, biomass. What do we really know about them? What are the advantages of renewable energy sources and what they are their disadvantages? Discover nature that drives our technical world!
- Come to it! Brain and scientific toys that train memory, reflexes, coordination and combination skills not only the smallest visitors Techmania.
- Trends in modern transport: As we will in the future be transported to school or work? The new exhibition is designed for all lovers of technical news. Visitors can ride the vehicle of new generation, which works on the principle of inverted pendulum.
- 150 years of industry in Plzeň Region. Products from the Skoda Company like locomotives, trolleybuses and also demonstration of a steam engine, short films, models of trams and buses. The Škoda exhibition tells the story of the largest industrial company in the Czech Republic and its contribution to past and current Czech manufacturing achievements (Techmania Science Center, 2014).

Planetarium

With the aim to come up with new ideas for popularization of science and to extend the tools of informal education which Techmania has to offer, the science center decided to create a very special planetarium. The Planetarium offers many exhibits that tell the story of space exploration and the universe in which we live (Techmania Science Center, 2014).

In the Planetarium there is a unique screen “Science On a Sphere”. There are just 100 of these screens around the world. It serves as an educational tool to help illustrate e.g. atmospheric storms, climate change, and ocean temperature. It is used to explain sometimes complex environmental processes, in a way that is simultaneously intuitive and captivating.

Another exhibition is called The Space Exhibition which contains 27 interactive exhibits. Here we can see the Universe and touch it. This is based on personal experience so thanks to manipulation we can understand how it works (Techmania Science Center, 2014).

Techmania Science Center received 51,504 visitors in 2012. The visitor count was less than previous years due to the renovation of the main science center. The number of visitors during previous years is displayed in the Table 1 (Techmania Annual Report 2012, 2013).

Table 1: Attendance in Techmania Science Center

Attendance	2009	2010	2011	2012
Total	73 819	66 181	72 488	51504
Daily	176	181	199	141

Source: Techmania Science Center (2014)

The new planetarium was opened in November 2013, and is the first facility of its kind in the Czech Republic. The new science center building completed in March 2014 with a total investment for the project totaling approximately 1 billion CZK or \$37 million USD will allow Techmania the space to expand exhibits and educational opportunity. Techmania has an annual budget of \$1.6 million USD. The total operating budget consists of \$450,000 USD in revenue from ticket and gift shop sales and \$1.15 million USD in grants from local government and the European Union. The largest contribution of \$28.85 million USD came from the EU and Czech Research and Development Operational Program for Innovation. (Techmania Annual Report 2012, 2013).

Important milestone for the future of non-formal education in the Czech Republic came at the end of the year 2011 when the Ministry of Education, Youth and Sports authorized their extensive project of the operational program called Research and development for innovations. That meant that they were able to begin with the completion of the science centre including the 3D planetarium. From the middle of 2014 there will become a unique concept of the popularization of science and technology on nearly 30,000 m² floor space. Of course, this means also the fulfillment of a dream and great satisfaction.

It presents the museum’s collections and results of its activities, in particular, by:

- museum’s permanent exhibition in the form of exposition
- exhibition activities
- publishing activities
- organizing of exhibitions, conferences, lectures and seminars (Techmania Annual Report 2011, 2012)

1.1.2 Discovery World

Discovery World was established in 1982 as a 501(c) 3 non-profit organization. The first facility was opened in the west wing of Milwaukee Public Library in 1984. Discovery World has continued to grow and expand its educational role in the seven county area surrounding Milwaukee. In 2004 Discovery World merged with Pier Wisconsin and Great Lakes Future, expanding its focus on fresh water and environmental education. In 2006 Discovery World and the historic S/V Denis Sullivan Schooner moved to its new home, a 120,000 sqft. facility on Lake Michigan.

Picture 2: Discovery World building



Source: Discovery World (2014)

Since the opening of the lake front facility, over 2.5 million visitors have enjoyed entertainment and educational experience. The current facility includes interactive science, technology, fresh and salt-water exhibits, aquariums, learning labs, theaters, and S/V Denis Sullivan Schooner. Discovery World's mission is to educate, motivate, mobilize, as well as inspire the innovators and entrepreneurs of the 21st century. The purpose is to continue to provide unique opportunities for learners of all ages (Discovery World Annual Report 2012, 2013).

Discovery World has been very successful in integrating local business and technology leaders into the educational experience. The first corporate sponsored exhibit in the new facility was developed and funded by Rockwell Automation. Rockwell Automation has Briggs & Stratton, Wisconsin Energy Corp, Caterpillar, Johnson Controls, Les Paul Foundation, We-Energies, Kohl's Department Stores, and MillerCoors are all examples of Wisconsin based businesses and organizations that have sponsored many of the exhibits and labs at Discovery World. The following exhibits are currently on display (Swabek, 2014) -

- Reiman Aquarium: Features Great Lakes, North Atlantic, and Caribbean aquatic life. Also includes Touch Tanks that provide personal interaction with fresh and saltwater aquatic life.
- Helen Bader Foundation's Great Lakes Future: World's largest model of the Great Lakes built to scale.
- The Challenge: Life size re-creation of an 1852 Great Lakes Schooner.

- Milwaukee Metropolitan Sewerage District City of Freshwater: Explores how freshwater purification and abundance builds cities and creates economic opportunity.
- Badger Meter Liquid House: A structure built from walls of moving water, demonstrating how water is an important community sustaining resource.
- MillerCoors THIRST Freshwater Innovation Lab: a hands-on learning Lab where visitors can explore water chemistry, microbiology and organisms, properties of water, and water-based business and technology opportunities.
- Johnson Controls TechnoJungle: Interactive exhibit exploring technology, sustainability, inventions, and ideas.
- The HIVE: Interactive total immersion, virtual reality environments.
- Energy & Ingenuity sponsored by the Wisconsin Energy Foundation: Explores the inside of a nuclear reactor and the myriad ways in which electricity is generated and distributed.
- CleanAir Trek sponsored by the Wisconsin Department of Natural Resources and the Wisconsin Department of Transportation: Focuses on eco-driving, alternative transportation technologies, and air quality in Southeastern Wisconsin.
- Distant Mirror - Introduces archaeology through an exploration of the tools and technologies archaeologists use to uncover the past.
- Kohl's Design It! Lab: Visitors can select from a menu of interactive design-build projects that use technology, tools, and techniques to create items such as vacuum-formed snowflakes, laser cut architectural model houses, wire frame jewelry, or an upcycled backpack.
- Les Paul's House of Sound: Special exhibit focusing on the life and innovations of Waukesha native Les Paul, who pioneered significant technological advances in modern music.
- Rockwell Automation Dream Machine: Uses models of local landmarks to demonstrate how automation and control are a part of daily life.
- Briggs & Stratton Milwaukee Muscle: Explores simple machines and how innovation helps humans develop different forms of technology for travel and movement.

Discovery World's education program focuses on Science, Technology, Engineering, and Mathematics (STEM). We enhance this focus by connecting STEM to concepts that motivate students beyond the classroom through educational programs in new media, design, creativity, and innovation. The Discovery World approach educates for the workforce, prepares for post-secondary education, and introduces students to entrepreneurial thinking. To deliver this model, Discovery World focuses on freshwater, robotics and automation, entrepreneurship and innovation, and digital media (Swabek, 2014). Discovery World has a strong focus on its current educational links with Milwaukee Public Schools (MPS) and UW Milwaukee (UWM). MPS and UWM have integrated the labs and other educational curricula developed by Discovery World into their science and technology programs. Students spend a portion of their semester onsite in Discovery World labs gaining real life experience. All lab programs are aligned with the Wisconsin Model Academic Standards and feature hands-on, inquiry-based instruction (Swabek, 2014). Discovery World continues to stay tightly focused on integrating its educational curriculum into more school systems through custom field trips and lab activities. A professional educators continuing education program is also offered to assist teachers in integrating the learning opportunities into their classrooms.

Discovery World operates on a minimum annual budget of \$6 million USD. The annual budget is typically split 60/40 earned revenue and donations from corporate sponsors and

individual donations. In 2013 Discovery World generated nearly \$6.5 million in total revenue, with approximately \$4 million from revenue and \$2.5 million in donations. Discovery World had ~\$6.2 million in expenses for the year ending 2013 (Discovery World, 2013).

1.2 Key Challenges

1.2.1 Techmania Science Center

Techmania Science Center is a much younger organization than Discovery World. Techmania receives its operating budget needs primarily from local and EU funding sources. Revenue from ticket sales is only 28% of the annual budget. As the Czech Republic and the Pilsen region continue to transition to a democratic society, public funding for organizations like Techmania could be at risk. Techmania has been founded by two major organizations, University of West Bohemia and Škoda Company, but is not currently receiving any annual funding from either organization. Škoda Company has been generous in providing land and unused buildings on the original manufacturing campus, but is not responsible for the conversion or maintenance of these facilities. Techmania does not receive any corporate grants or funding at this present time. Outside of the new Škoda historical exhibit, Techmania does not have any corporate sponsored exhibits that teach a science, technology, or engineering principles (Techmania, 2012). Techmania does not currently receive any other sources of private grants, or donations to fund and grow the educational reach of the organization. Even University of West Bohemia (UWB) does not donate Techmania but UWB presents its researches through Techmania.

A critical need of Techmania is getting the community more involved not only in visits to the facility, but in workshops, labs, and other events that can drive ticket sales and other revenue generating activities. Techmania hosts small focused workshops on a periodic basis, but does not have hands on labs that teach and provide real life experience of science and technology subjects. Local public and private elementary, and secondary schools bring participants to Techmania, but do not currently integrate their science and technology curriculums with those of the science center. Techmania is using local advertising on billboards, trollies, and bus stations to make the local community aware of the new planetarium and science center. The current advertising is bringing awareness to the center and its exciting new exhibits and driving ticket sales, however once the initial excitement of the new centers wears off, how will new and repeat visitors be maintained? Techmania does not currently have a membership or private event program to drive revenue and greater involvement of the community.

Techmania is in close relationship with the directors of schools. Usually these relations are provided by the Department of Education, Youth and Sports of the Pilsen Region. Directors of the schools have to encourage pupils to go to Techmania. At first are the directors invited to Techmania where they are getting familiar with exhibitions and services offered by Techmania. Another way how to motivate directors and pupils is competitions which are announced by the Department of Education, Youth and Sports. These competitions are focused on science and technology or some of them on promoting Techmania. For example in these competitions pupils were creating promoting leaflets, posters or videos. Their works are evaluated and awarded and then exhibited in the premises of Techmania. These activities lead to higher and more frequent visits of Techmania. At the end of each school year there are awarded schools from Pilsen Region which visited Techmania during the year the most.

1.2.2 Discovery World

Discovery World was founded 31 years ago as an organization focused on innovation and science education. Discovery World has grown substantially, serving over 300,000 people in 2013, but is not growing at the pace it did in past years (Discovery World Annual Report, 2013). In 2010 Discovery World served 360,526 people and had higher participation in labs and other special events (Discovery World Annual Report 2012, 2013). Discovery World is in need of a re-branding and a fresh image as a leader in science, technology, and engineering innovation and education. Brand awareness studies of people living outside of the City of Milwaukee have shown that Discovery World – Center for Public Innovation, is either unknown or misunderstood (Swabek, 2014). The term “innovation center” or “center for public innovation” has been widely used in the business and investment world as a term for new business incubator or educational co-op. The “Center for Public Innovation” tag line maybe a misleading description for Discovery World and detract from its true purpose and message. Discovery World has not conducted a public advertising campaign with the intent to drive higher ticket sales for several years. The project team as well as the Discovery World development team believes the center needs to focus on brand awareness and promotion of its mission as a science and technology center.

Discovery World has weathered the financial crisis of 2008 and the persistent market instability, resulting in a slow recovery. Between 2010 and 2011 the organization saw a ~23% drop in corporate sponsorships and private donations and was forced to pull back on expansion of programs, refresh of exhibits, and lab activities (Swabek, 2014). All employees took a reduction in salary or hourly compensation to reduce the payroll expenses and conserve capital. The financial crisis has brought to light the need to expand the outreach to corporations and large foundations in seeking sponsorship of labs as well as other programs that were internally funded from the sale of tickets. Discovery World has not focused much effort on smaller private donations because of the resource constraints in the development organization. Most organizations the size of Discovery World has built substantial endowment funds to assist in growing programs, providing scholarships etc. The average endowment for a Discovery World sized organization is maintained at ~\$30 million USD, Discovery World which only has a small endowment valued at ~\$1 million USD.

Discovery World has developed a strong relationship with Milwaukee Public Schools (MPS) to integrate the educational programs of fresh water conservation into the earth science curriculum. MPS has integrated many of the other science and technology labs into its educational requirements for students. Many other school districts have field trips to Discovery World as well as participate with mobile exhibits and labs, but have not integrated any of the educational programs or labs into their curriculum. An example of the lack of involvement from local public schools is Elmbrook School District and Waukesha School District in Waukesha County. Neither one of these districts have field trips or involvement in labs or other science and technology programs provided by Discovery World. Discovery World has begun to integrate its programs into higher education, but in a limited way. The UWM Robotics and digital literacy program is a solid example of the early success of Discovery World in college study. Discovery World has not successfully expanded such programs into other colleges and universities.

Techmania Science Center and Discovery World have similar challenges to resolve in the future.

1.3 Suggested Solutions

1.3.1 Future of Techmania Science Center

Techmania is currently receives ~72% of its operating revenue from the City of Pilsen and the associate regional government and the European Union. As long as the public funding sources stay in place, Techmania can maintain the current level of operations and exhibits. The risk to Techmania is that local public policy related to funding non-profit organizations can change and that the EU could pull back sponsorship of science and technology education funding due to austerity and other financial crisis issues. To ensure the long-term mission of providing a science and technology education to young people, Techmania needs to increase revenue from self-generated revenue. The Marquette and UWB project team believes the following suggestions should receive serious consideration -

- Introduce Community fund raising events – Techmania should develop a program of community events such as an annual gala to include dinner, music, dancing, wine tasting, silent auctions etc. Holding annual community events will become a valuable source of revenue and increase awareness of its programs with potential private and corporate donors. An example of the success of an annual gala and silent auction was the 2012 event held by Discovery World, which generated over \$230,000 in revenue in one evening.
- Create Membership Packages – Techmania currently generates revenue from daily ticket sales. Many science and technology centers have developed membership programs as a source of annuity revenue. Annual memberships that allow unlimited access to the science center and planetarium should increase family and community participation. By implementing a membership program, Discovery World was able to increase annual revenues ~16% per year. The membership concept is new to the Czech Republic, but with proper structuring and promotion the project team believes the public will participate in the program.
- Corporate Sponsorship – The Czech Republic has a rich heritage of industry and technology. Techmania should develop an outreach program to solicit participation of corporate sponsored exhibits. Corporate sponsored exhibits tie science and technology topics to real world application. By demonstrating the application of technology and engineering, the concepts become real and the imagination in young people is stimulated. Corporate sponsored exhibits promote Czech business and promote goodwill, while expanding the educational mission of Techmania.
- Program/Curriculum Development – Techmania should consider a focused program to develop science and technology curriculum that can be integrated with public and private school systems. Based on available information at the time this paper is being written, it does not appear that public primary or secondary science or technology curriculum is being developed to incorporate Techmania programs. Techmania should develop learning labs and other programs that provide focused hands on learning opportunities for students of all ages. Learning Labs can be developed into a powerful source of revenue for Techmania. Examples of successful learning labs are – Bio Lab focused on human anatomy and biology, Electronics Lab focused on current and future electronics trends, General Science Lab, and a Water Science and Conservation Lab. These Labs will serve instead of school labs. They will provide better conditions and well equipped space for education young people.
- Community Support – Techmania should consider promoting its facilities for weddings, birthday parties, school events etc. The special events will become another source of revenue and increase the community awareness of the Techmania mission and facilities. Fun family onsite educational activities and classes can be held on

a monthly or quarterly basis to increase community participation and revenue. Techmania should consider incorporating lower cost exhibits that change frequently, as to keep the interest and excitement levels high in young people's minds. The short-term exhibits should be time-bound and promoted in the current advertising and marketing campaigns.

Each of the potential programs discussed above are new concepts in the Pilsner Region and Czech Republic as a whole. It will take time and dedicated effort to develop these programs and revenue generating concepts. Once developed, Techmania will have a larger annual budget to build from and a hedge against the future loss of public funding.

1.3.2 Discovery World Science and Technology Center

Discovery World has successfully built a powerful science and technology educational system. Despite the economic instability in the Milwaukee Metro since 2008, Discovery World has been able to maintain its programs. In order for Discovery World to make a larger impact in the science and technology education of young people, revenues and private donations, and public education involvement need to increase. The Marquette and UWB team believes the following concepts should be considered in future growth planning -

- Increase Corporate Sponsorship and involvement – Discovery World has been very successful in securing corporate sponsored exhibits and donations. An expanded outreach to agencies of current sponsors may yield expanded educational opportunities and funding. An example of a corporate adjacency is Cisco Systems. Rockwell Automation and Johnson Controls (JCI) are alliance partners. Rockwell and JCI incorporate Cisco technology solutions into their manufacturing and building management solutions. Cisco, Rockwell Automation and Johnson Controls are also powerful promoters of STEM, a federal government program to promote science, technology, engineering, and math education and careers. By connecting or expanding the current exhibits to include such agencies, new technology education opportunities will emerge. Discovery World should also consider expanding its focus on biotechnology and biomedicine. The University of Wisconsin has a well-funded program that could potentially be a source of education and revenue. A large contributor to the UW Bioscience program is the Mortgridge Foundation, controlled by John Mortgridge, former CEO of Cisco Systems and Wauwatosa native. Connecting the dots of corporate and philanthropy could prove to be a powerful source of future funding and educational material. Finally a renewed focus on recruiting involvement and funding from Harley-Davidson, General Electric and other large Wisconsin businesses should be a solid focus going forward.
 - Expand Private Donation Solicitation. It is connected with previous point. There is an intention to increase private donations. Discovery World needs to place a renewed emphasis on private individual and private foundation donations. Currently there is not a dedicated person or group focused on individual donations. By focusing on high net worth individuals, that may not currently live in Milwaukee or Wisconsin, but were raised in Wisconsin and Milwaukee, Discovery World should be able to capture donations that are potentially going to organizations out of the state.
 - Restructure Structure pricing. In comparison with Techmania Science Center the admission is little bit higher but it contains everything. In Techmania there is a possibility to choose one of the five different tours. And the price is dependent on the tour. In Discovery World there is just one tour and there is an opportunity to split this one tour between more tours. It is possible to separate exhibits in different parts of building or digital movie theater. Other

possibility is that Discovery World should consider offering a tiered ticket pricing structure such as:

- Adult or Child General Admission - Potentially lower than the standard all-inclusive daily tickets to draw in larger number of visitors.
- Adult or Child General Admission + All theaters - Capitalize on individuals who are interested or have the time to see the exhibits and theater presentations
- Family Day Pass - Special pricing for families that make the visit to Discovery World more financially feasible.
- Membership packages should be reduced in number and simplified as to reduce indecision.
- Expand Endowment - Discovery World has a very small endowment fund of approximately \$1 million USD. Most organizations of its size and age have endowments of ~\$30 million USD. The Discovery World executive team should consider investing in an experienced individual with proven track record and solid connections to high net worth individuals to lead the endowment fund raising effort. The larger endowment would be used to provide a safety net in the event of future financial downturn. The interest of dividends from a well structure endowment could be used to fund programs and offer special scholarships to high potential youth.
- Community Support
 - Expand the development of school curriculum coordinated with Discovery World - Milwaukee Public Schools have successfully begun science and technology curriculum integration with the programs offered at Discovery World. The Marquette and UWB project team suggests that these programs be aggressively marketed to other area school districts to encourage young people to consider a career in technology, science, or engineering. School districts may be able to secure STEM grants from the Federal Government by integrating their science, technology, and math programs with other STEM recognized organizations such as Discovery World.
 - Develop school curriculum coordinated with Discovery World. Discovery World continues to stay tightly focused on integrating its educational curriculum into more school systems through custom field trips and lab activities. A professional educators continuing education program is also offered to assist teachers in integrating the learning opportunities into their classrooms.
 - Lower cost exhibits that change more frequently. Discovery World has historically built large, high priced exhibits that change infrequently. The continued interest of young people returning to Discovery World is driven by a desire to see new things and learn new ideas. If exhibits change infrequently, it is more difficult to retain the interest of young people. The Marquette & UWB project team suggests that Discovery World and its corporate partners consider building lower cost exhibits which are refreshed more frequently. When there is an intention to increase the attendance it is necessary to change the exhibits more often to entice people for a visit. Most of the exhibits are permanent and also people would not like to see them every time. There is a possibility to create some smaller exhibit in one area which would be changing several times a year. There should be focused on some special or actual topics. Even this shorter tour would be for reduced price.

- Using more film and electronic media to drive greater interest. The Discovery World like a representative of technique and modern technologies should perform in public also in this way and develop in this direction. The use of electronic media and educational and computer games or simulations are powerful tools to capture the attention and imagination of today's young minds (Swabek, 2014).
- Re-Branding and Advertising could bring new fresh identity in the minds of customers. Nowadays there is no big advertising campaign. Discovery World has used the sub-title of "Center for Public Innovation" for 30 years. The science and technology focus of Discovery World and the concept of public innovation are not synonymous in today's society. Discovery World needs to update the sub-title to reflect more clearly its focus on science and technology education. In 2014 Discovery World leadership have chosen to rebrand Discovery World as a "Science + Technology" center (Swabek, 2014). A new logo has been developed to place a fresh new face on the mission of the center, as seen here:

Picture 3: New logo



Source: Swabek (2014)

A public awareness advertising and marketing campaign needs to be launched to drive a renewed interest in the center, and the exciting technology contained inside. The advertising should be fun and youthful to draw the interest of young people to breathtaking world of science and technology. Social media, rich media email, and other Internet based tools should be used to promote fun events and labs. TV, Billboards, transit stops and city buses can also be used to deliver the Discovery World message.

Conclusion

Techmania and Discovery World are increasing the awareness of science and technology for young people. Financial challenges and community involvement will be persistent challenges in the future. The Marquette & UWB project team presented many key challenges and possible solutions for both Discovery World and Techmania Science Center. The senior management team from each organization should validate the perceived challenges and review and prioritize the suggestions. The project team believes the suggestions presented in the final paper will effectively grow revenue and improve the total number of visitors and the overall success of the educational outreach.

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